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# **Oil development and rural health in the Amazon basin of Ecuador: the popular epidemiology process**

**Miguel San Sebastián**

**Thesis submitted to the University of London in fulfilment of the requirement for the  
degree of Doctor of Philosophy in the Faculty of Medicine**

**Department of Public Health and Policy  
London School of Hygiene and Tropical Medicine**

**April 2001**



**To the peasants and indigenous of the ‘Oriente’  
who fight for a healthier environment and life**

## ABSTRACT

Recent decades have witnessed an increasing corporate access to and control over natural resources resulting in environmental degradation, inequalities and ill health. Since 1972, oil companies have extracted more than two billion barrels of crude oil from the Ecuadorian Amazon. During this process, millions of gallons of untreated toxic wastes, gas and oil have been released into the environment. Indigenous federations, peasants movements and environmental groups have claimed that contamination has caused widespread damage to both people and the environment.

This thesis tells the story of how the relationship between local organisations and research institutions developed around an epidemiological study constructed to address communities' concerns. Local organisations set the agenda of the research: they were involved in the hypothesis formulation, consulted in each step during the study and responsible of the dissemination of the findings. This process is known as popular epidemiology.

The epidemiological study examines the impacts of oil development practices on the environment and health of residents living in the proximity of oil fields. These residents were exposed to high concentrations of oil chemicals in water used for drinking, washing and bathing. The study suggested a higher risk of spontaneous abortions (POR: 2.47; 95% CI: 1.61-3.79) and adverse health effects such as skin mycosis, itchy nose and sore throat ( $p < 0.05$ ) among women living near oil fields. An excess of cancers among the male population was found in a village located in an oil producing area.

Practical and personal issues and dilemmas faced during the research process are discussed with emphasis on the communication and dissemination of the findings. The thesis concludes the need of alliances between communities and researchers in order to protect health and environment. Popular epidemiology is an essential approach for public health researchers to reaffirm their roots in improving public health as a primary value.



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## LIST OF ACRONYMS

BaP	Benzo[a]pyrene
BCSD	Business Council for Sustainable Development
CDC	Center for Disease Control
CDES	Centro de Derechos Económicos y Sociales (Center for Economics and Social Rights)
CFCs	Chlorofluorocarbons
CHWs	Community Health Workers
CI	Confidence Interval
CSR	Corporate Social Responsibility
E	Expected
FDA	Frente de Defensa de la Amazonía (Front of Amazon Defence)
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
HIA	Health Impact Assessment
ICC	International Chamber of Commerce
ICD	International Classification of Diseases
IESCMA	Instituto de Epidemiología y Salud Comunitaria “Manuel Amunárriz”
ISEE	International Society of Environmental Epidemiology
km	Kilometres
LSHTM	London School of Hygiene and Tropical Medicine
MAI	Multilateral Agreement on Investment
MMG	Medicus Mundi Guipuzcoa
MoH	Ministry of Health
MSc	Masters of Science
NAFTA	North American Free Trade Agreement
NGOs	Non Governmental Organisations
O	Observed
PAH	Polynuclear Aromatic Hydrocarbons
POR	Prevalence odds ratio
PP	Precautionary Principle
ppm	Parts Per Million
RMA	Red de Monitoreo Ambiental (Environmental Monitoring Network)

SIR	Standardised Incidence Ratio
SMR	Standardised Mortality Ratio
TNCs	Transnational Corporations
TPH	Total Petroleum Hydrocarbon
UK	United Kingdom
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
UPPSAE	Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana
USA	United States of America
USEPA	United States Environmental Protection Agency
VA	Vicariato de Aguarico
WBCSD	World Business Council for Sustainable Development
WICE	World Industry Council for the Environment
VOC	Volatile Organic Chemical



## ACKNOWLEDGEMENTS

I am grateful to the different women, men, all peasants from the “Oriente” of Ecuador who gave up their time and often their home for me during this study. Special thanks to the Frente de Defensa de la Amazonia. I have the greatest respect for their work.

I thank the Vicariato de Aguarico, especially Bishop Jesús Esteban and the capuchins José Miguel, Juan Carlos and Roque for trust and encouragement throughout the study and during my earlier work in the area. I am also grateful to the capuchin brothers in Peckham who opened the doors of their monastery when I needed a place to stay.

It was a pleasure to work with Santiago and Aníbal during the data collection. The collaboration of Sandi Yura and FUSA was essential during the fieldwork.

Judith Kimerling has generously shared her time and advices, I have gained much from discussions with her. Thanks also for letting me use her photos in my presentations.

I am also grateful to Medicus Mundi Guipúzcoa for funding. The friendship and support of Imanol Apalategui provided continuous encouragement at the different stages of the study.

At the London School of Hygiene and Tropical Medicine, Carolyn Stephens has offered guidance and excellent supervision. The enrolment in the PhD program had not happened without her encouragement. I am grateful for the many thought-provoking ideas she has fed me with. Thanks to Ben Armstrong for the revision of my epidemiological study and support throughout the study. Thanks also to Paul Wilkinson, Simon Lewin, John Porter for providing useful comments to earlier drafts. Special thanks to Romulo for opening my eyes during my final period of writing and for his advices in the many difficulties a student has.

This thesis would have been impossible without the encouragement and practical help provided by Hurtilin. Many thanks to family and friends in Spain and Sweden for their support.

# **CHAPTER ONE**

## **INTRODUCTION**

Since 1972, foreign companies together with Ecuador's national oil company have extracted more than two billion barrels of crude oil from the Ecuadorian Amazon. During this process, millions of gallons of untreated toxic wastes, gas and oil have been released into the environment. Since the beginning of oil development, indigenous federations, peasants movements and environmental groups in Ecuador have organised in opposition to unregulated oil development, charging that contamination has caused widespread damage to both people and to the environment (Jochnick et al., 1994; Kimerling, 1998; Almeida, 2000).

This thesis presents a study examining the impacts of oil development practices on the environment and health. It reports the environmental conditions and health of local people in a small area of the Amazon basin of Ecuador operated by the oil industry. The thesis also describes how local organisations, communities and researchers are brought together in a dialogue wherein joint discussion, decision making and problem solving are featured. This process has been known as popular epidemiology.

### **1.1. GLOBAL POLICIES, ENVIRONMENT AND HEALTH**

Despite some serious shortcomings, the United Nations Conference on Environment and Development (UNCED) in 1992, also known as the Rio Earth Summit<sup>1</sup>, raised high hopes of a new partnership between North and South to establish a more equitable international

---

<sup>1</sup> For more information: <http://www.unep.org> and <http://www.ciesin.org/datasets/unced/unced.html>.



economic order that would lay the basis for tackling the global ecological crisis and promoting sustainable development both nationally and globally (Parson et al., 1992; Goldman, 1992; United Nations Development Programme, 2001). The unique and important achievement of UNCED was that through its long preparatory and Summit processes, the world's diplomats and highest political leaders recognised not only the environment crisis in its many facets, but how this was embedded in economic and social systems, and that a realistic and long-term solution lay in dealing with both the environment and the development crises simultaneously and in an integrated fashion (Khor, 1997).

Eight years on, it is now clear that these hopes have not been fulfilled. While world attention was concentrated on prospects for resolving the social and ecological crisis, far from the media assembled in Rio, trade ministers met secretly in Geneva to finalise a lesser-known agreement that would expand world trade and thus have far greater impact on natural resource exploitation into the next century (Khor, 1997; Menotti, 1998). That agreement, known as the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), focused on ecological sustainability through economic globalisation, undermined Rio's many government declarations and action agendas (Vidal, 1994; Karliner, 1999; Stephens et al., 2000). The conclusion of the Uruguay Round in December 1993 heralded a new era where multilateral trade agreements and negotiations would subject countries much more to the objectives of Northern governments advocating greater and wider "market access" for their corporations (Khor, 1997).

Since Rio, governments have demonstrated enormous energy and political will to forge new free trade agreements that increase corporate access to and control over natural resources and

consumer markets<sup>2</sup>. These international trade and investment agreements have allowed transnational corporations (TNCs<sup>3</sup>) to circumvent the power and authority of national governments and local communities endangering workers' rights, the environment and democratic political processes (Wolfe, 1995; Wallach and Sforza, 1999). These treaties serve as the framework within which international and national trade is evolving, allowing international corporate investment and trade to flourish across the Earth (Karliner, 1997; Stephens, 2000).

Some argue that the unwillingness or inability of national governments to control TNCs in a period of deregulated global trade and investment has not boded well for people's health or the environment (Van Der Meer, 1993; Rich, 1994; Korten, 1995; Stephens et al., 2000). Many agree that the process of globalisation has made the gap between rich and poor greater, both within and between countries and has had important consequences for the level of investment and development of the health services as well as for the major determinants of health (Smith, 1998; Stephens et al., 2000; Hong, 2000)<sup>4</sup>. In addition, TNC operations routinely expose workers and communities to an array of health and safety and ecological dangers (Moberg, 1997; Greer and Singh, 2001).

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<sup>2</sup> For instance, the GATT (now administered by the World Trade Organisation), the Asia-Pacific Economic Community, The North American Free Trade Agreement (NAFTA), The European Union. Recently, governments tried to implement the Multilateral Agreement on Investment (MAI) which was stopped by public pressure (<http://www.corporatewatch.org>).

<sup>3</sup> Transnational corporations are among the world's biggest economic institutions. A rough estimate suggests that the 300 largest TNCs own or control at least one-quarter of the entire world's productive assets, worth about US\$ trillion. TNCs' total annual sales are comparable to or greater than the yearly gross domestic product (GDP) of most countries; Itochu Corporation's sales, for instance, exceed the GDP of Austria (Greer and Singh, 2001).

<sup>4</sup> For instance, in South America, Structural Adjustment Programmes have rolled back the progress achieved in the 1960s and 70s. The number of people living in poverty rose from 130 million in 1980 to 180 million at the dawn of the 1990s (Bello, 1996). Income disparities widened with privatisation and deregulation, as massive resources were concentrated in the hands of a few. In Mexico, the richest 20% received more than 52 percent of the national income while the income of the poorest 20% had less than five% (Heredia and Purcell, 1996).



Regarding the environment, TNC activities generate more than half of the greenhouse gases emitted by the industrial sectors with the greatest impact on global warming. TNCs control 50% of all oil extraction and refining, and a similar proportion of extraction, refining, and marketing of gas and coal. Additionally, TNCs have virtually exclusive control of the production and use of ozone-destroying chlorofluorocarbons (CFCs) and related compounds (Karliner, 1997; Pha, 2001). TNCs control 80% of land world-wide which is cultivated for export-oriented crops, often displacing local food crop production. Twenty TNCs account for 90% of the sales of hazardous pesticides. Additionally, because TNCs control much of the world's genetic seed stocks as well as finance the bulk of biotechnology research world-wide, they are poised to reap large financial rewards from patenting life forms (Pha, 2001; Greer and Singh, 2001).

Others agree that despite the environmental risks, TNCs can also produce environmental gains, such as helping developing countries leapfrog to the cleaner technologies of tomorrow. China has become the world's largest manufacturer of energy-efficient compact fluorescent light bulbs in recent years, in part through joint ventures with lighting firms based in Hong Kong, Japan, the Netherlands and Taiwan. And India has become a major manufacturer of advanced wind turbines with the help of technology obtained through joint ventures and licensing agreements with Danish, Dutch and German firms (French, 2000).

In recent years, leaders of some of the world's most powerful corporations have begun calling for environmental change. These TNCs gathered under the World Business Council for

Sustainable Development (WBCSD)<sup>5</sup>, which has become the pre-eminent business voice on sustainable development, aim to develop closer co-operation between business, government and all other organisations concerned with the environment and sustainable development. The WBCSD also seeks to encourage high standards of environmental management in business itself. Corporate Social Responsibility (CSR) has been identified as a growing issue for many companies and the WBCSD views CSR as the third pillar of sustainable development - along with economic growth and ecological balance - and therefore a key component for a sustainable future (World Business Council for Sustainable Development, 2001).

## **1.2. THE OIL INDUSTRY IN THE ORIENTE**

Oil is a major source of income for Ecuador and since 1972 has been the engine of the economy. The 1970s oil price boom lifted Ecuador's economy -formerly one of the poorest in Latin America- by an average of 7% annually, with per capita income rising from \$290 in 1972 to \$1,490 in 1982 decreasing to \$1,390 in 1995 (Kimerling, 1991; Martínez, 2000). Today, oil continues to account for 40% of the nation's export earnings and government budget. Most of this oil comes from the north-eastern part of the country, the Amazon basin (Figure 1-1). A detailed description of the country scenario is presented in appendix 1.

The Amazon basin of Ecuador, known as the "Oriente", consists of more than 40 million hectares of tropical rainforest lying at the headwaters of the Amazon river network. The region contains one of the most diverse collections of plant and animal life in the world (Myers, 1984; Cabodevilla, 1997). The "Oriente" is also home of some 500,000 people,

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<sup>5</sup> The World Business Council for Sustainable Development (WBCSD) is a coalition of some 150 international companies united by a shared commitment to sustainable development, i.e. environmental protection, social equity and economic growth. Their members are drawn from 30 countries and more than 20 major industrial sectors. The WBCSD was formed in January 1995 through a merger between the Business Council for Sustainable Development (BCSD) in Geneva and the World Industry Council for the Environment (WICE), an International Chamber of Commerce (ICC) initiative, in Paris (<http://www.wbcd.ch/whatis.htm>).





**Figure 1-1. Map of Ecuador; inside the circle, the north-eastern region where oil companies operate.**

(Source: [http://www.lib.utexas.edu/Libs/PCL/Map\\_collection/americas/Ecuador\\_rel91.jpg](http://www.lib.utexas.edu/Libs/PCL/Map_collection/americas/Ecuador_rel91.jpg))



including eight groups of indigenous people, as well as recent peasants from Ecuador's coastal and highland regions (Fundación José Peralta, 1999).

In 1967, a Texaco-Gulf consortium discovered a rich field of oil beneath the rainforest, leading to an oil boom that has permanently reshaped the region. While the state has retained dominion over all mineral rights, several private foreign companies have built and operated most of the oil infrastructure. The "Oriente" now houses a vast network of roads, pipelines and oil facilities. Settlers, attracted by the roads and encouraged by government land policies entered in large numbers, clearing vast regions of the rainforest and displacing indigenous inhabitants (Kimerling, 1991). Despite the presence of indigenous peoples, Ecuadorian law treats the vast majority of Amazonian territory as "unoccupied lands". The law declares colonisation of these lands to be an urgent national security priority, and offers land titles to settlers who clear the forest for crops or pastures (Fabra, 1998). This process has contributed to a deforestation rate of almost a million acres a year in the "Oriente", one of the highest rates in Latin America (Jukofsky, 1991). Currently, most of the "Oriente" is planned for more oil development (Centro de Derechos Económicos y Sociales, 2000a)<sup>6</sup>. For a more detailed account on Ecuador's oil policies and oil economy dependence, see appendix 2.

Some observers have questioned the environmental practice and technologies used by oil companies for oil exploration in the "Oriente" (Jochnick et al., 1994; Kimerling, 2000; Almeida, 2000). Exploration for crude oil has involved thousands of miles of trail-clearing and hundreds of seismic detonations that have caused erosion of land and dispersion of wildlife. Each exploratory well that is drilled produces an average of 4,000 cubic meters of

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<sup>6</sup> The government of Ecuador has launched a public campaign called "*Ecuador Apertura 2000*" (Ecuador Opening 2000) which consists, among other things, to allow oil exploration in nearly two million hectares of tropical forest in the South of the country.

drilling wastes (drilling muds, petroleum, natural gas and formation water) from deep below the earth's surface. These wastes are deposited into open, unlined pits called separation ponds, from which they are either directly discharged into the environment or leach out as the pits degrade or overflow from rainwater (Jochnick et al., 1994) (Photo 1-1).

If commercial quantities of oil are detected, the production stage starts. During production, oil is extracted in a mixture with formation water and gas and separated in a central facility. At each facility, over 4.3 million gallons of liquid wastes are generated every day and discharged without treatment into pits. Roughly 53 million cubic feet of "waste" gas from the separation process are burned daily. The gas is burned without temperature or emissions controls, and contaminants from the gas flares pollute the air. Additional potential contamination of the air is generated at pits and oil spills by hydrocarbons coming from standing oil slicks (Kimerling, 1991; El Comercio, 1999a) (Photo 1-2).

Routine maintenance activities at over 300 producing wells discharge an estimated 5 million gallons of untreated toxic wastes into the environment every year. Leaks from wells and spills from tanks have been common (Almeida, 2000). According to a study conducted by the government in 1989, spills from flow lines alone were dumping an estimated 20,000 gallons of oil every 2 weeks (Dirección General de Medio Ambiente, 1989) (Photo 1-3, 1-4).

In 1992, the Ecuadorian government recorded approximately 30 major spills with an estimated loss of 16.8 million gallons of crude oil (Jochnick et al., 1994). This compares to the 10.8 million gallons spilled in the Exxon Valdez disaster in 1989. For instance, in 1989 at





**Photo 1-1. A typical unlined pit which receives toxic wastes from an oil separation station. All wastes will either seep into the groundwater or spill into nearby surface waters and forests (*photo FDA*).**



**Photo 1-2. Open fire in a waste pit. Local residents report black rain" following fires, which they say coats clothing, crops and water with ash and causes skin rashes (*photo J. Kimerling*).**

*Oil spill cleanup in the rainforest of Ecuador (photo)*





**Photo 1-3: Oil spill in the land of a peasant (photo CEDIS).**



**Photo1-4. Workers cleaning an oil spill in the rainforest of Ecuador (photo J. Kimerling).**



least 294,000 gallons and in 1992, about 275,000 gallons of crude oil caused the Napo river (1 kilometre wide) to run black during one week (Rainforest Action Network News, 1998). Recently, in December 2000, the Tiputini river, that crosses the Yasuni National Park and is one of the major tributaries of the Napo river, ran black with oil during more than 10 days (capuchin priest, personal communication). Overall, more than 30 billion gallons of toxic wastes and crude oil had been discharged into the land and waterways of the “Oriente” until 1993 (Dirección General de Medio Ambiente, 1989; Jochnick et al., 1994).

### 1.3. COMMUNITY ORGANISATION

In the “Oriente”, concern over oil development related pollution was raised a long time ago by residents of oil producing areas. Both peasants and indigenous people have reported that many local streams and rivers, once rich in fish, now support little or no aquatic life; cattle are reported to be dying from drinking from contaminated streams and rivers. These are typically the same waters people use for drinking, cooking, and bathing.

As a peasant remembers from the oil exploitation initial period:

*“the creek and rivers around here were suddenly full of oil, and everyone thought oil is good. Many animals, especially cows, would drink the water and die. And we had no idea why”* (peasant, personal communication).

Peasants and indigenous people from the Amazon have presented their complaints to the different governments. The demands ask for better quality of life, presence of basic needs, technical assistance and overall, cleaning of the oil pollution. Local populations, through their organisations, and supported by national environmental groups have demanded that the companies clean-up the environmental pollution and compensate them for damages caused by



oil related contamination. But the measures adopted by oil companies and governments have been described as “patches” (to cover some waste pits, to build some schools, to open a path) without facing the root of the problem (Varea, 1995; Garzón, 1995).

In November 1993, a lawsuit was filed against Texaco, an oil company that worked more than 20 years in the area, for about 30,000 indigenous and peasants, who claimed that the oil company had caused irreparable damage to the rain forest. This suit, dismissed in November 1996 by the New York federal court, was accepted again in 1998. Currently, the Judge has to decide if the trial continues in New York or is sent to Ecuador. A summary of the Texaco case is presented in appendix 3.

In 1994, the *Frente de Defensa de la Amazonía* (FDA, Front of Amazon Defence) was created with the participation of several peasant and indigenous organisations with the initial aim of supervising the lawsuit against Texaco oil company. Later, the complexity of the problem and the lack of overall information within the communities led the *FDA* to organise numerous workshops on environmental rights, oil spill reports, community meetings and visit of government officials to contaminated places. The proposal of the *FDA* for a better management of the environment is summarised as follows:

- The control and management of the petroleum activities must be done by the government and not transferred to the private sector or foreign companies.
- The government commitment to the social inequalities must be a priority to the payment of the external debt.
- The protected areas in the rainforest must be respected and no oiling, mining, logging, agro-industry or colonisation activities must be permitted.

- The local population must have the right to be consulted and to participate in the decisions on the petroleum activities in the area.
- A greater share to the population of the income generated by the oil activities in the Amazon basin.

As result of these experiences, the *FDA* felt the need to strengthen the movement and looked for alliances among other local and national environmental groups. In 1996 the *Red de Monitoreo Ambiental de la Amazonia Ecuatoriana* (RMA, Environmental Monitoring Network), an environmental regional grass-roots organisation involving different local and national Non-Governmental Organisations (NGOs), was created with the aim of coordinating activities and sharing information among the different organisations (Boletín de la Red de Monitoreo, 1997).

The objectives of the *RMA* are summarised as follows:

- to establish a relationship of support and help at a local, national and international level to defend the Amazon basin and the environmental and social rights of their residents.
- to strengthen the space of community surveillance on the socio-environmental behaviour of the companies operating in the Amazon basin.

During the period, some leaders of affected communities accepted from Texaco and the Ecuadorian government small offers and left the trial and the activism. Others, however, have continued in opposition to this development. *FDA* has argued that their demands, demonstrations in Quito, their presence in oil investors meetings, their commitment to the environment and the people, together with the support of national and international



environmental groups have been the corner stones in this process (Frente de Defensa de la Amazonía, 1999).

#### **1.4. ALLIANCE BETWEEN ORGANISATIONS AND RESEARCH INSTITUTIONS**

Since the beginning of the oil exploitation in the “Oriente”, peasants and indigenous people have reported that bathing in the river waters causes skin rashes, especially after heavy rains, which accelerate the flow of wastes from nearby pits into the streams (Kimerling, 1995).

*“Our animals drink from the river and the lake so some of them too have died. There have also been skin and intestinal problems among the people as we wash in the rivers and always use the water for cooking”* (peasant, personal communication).

*“There are times when you bath in the river, your body gets full of rashes, and that never happened before. Recently, I went bathing in the river, and my body got rashes”* (indigenous, personal communication).

In 1993, a local community health worker’s association (Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, UPPSAE) conducted a descriptive study in their communities. The study suggested that exposed communities had elevated morbidity - higher occurrence of abortion, dermatitis, skin mycosis, malnutrition - and mortality rates (Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, 1993).

In 1994, the Ecuadorian environmental and human rights organisation *Centro de Derechos Económicos y Sociales* (1994) (CDES, Center for Economic and Social Rights), released a report documenting dangerous levels of toxic contamination and related health problems in



Ecuador's Amazon. The study reported skin problems (dermatosis) among the local population, apparently related to petrol contamination. In addition, concentrations of polynuclear aromatic hydrocarbons were found in drinking, bathing and fishing waters. These were 10 to 10,000 times greater than the United States Environmental Protection Agency (USEPA) guidelines.

During the last years, the constant pressure of oil companies and government to provide proofs of a danger to human health from oil pollution led some members of the *RMA* to consider the need for a more detailed epidemiological study to support the environmental groups and communities. The *RMA* approached the *Instituto de Epidemiología y Salud Comunitaria "Manuel Amunárriz"* (IESCMA), a local health Non Governmental Organisation (NGO) under the *Vicariato de Aguarico* (VA)<sup>7</sup> to help them to determine the possible impact of oil pollution on the health of their communities.

This thesis tells the story of how the relationship between local organisations and national and international research institutions developed and how this study on environment and health was conducted. In this study, local organisations and the epidemiologist were in constant dialogue. It was the *RMA* who set the agenda of the research: they were involved in the hypothesis formulation, consulted in each step during the study and responsible of the dissemination of the findings (see also section 4.1). This process is known as "popular epidemiology" (Brown, 1992).

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<sup>7</sup> The *Vicariato de Aguarico* (VA) is a catholic diocese working on health in the area since the 50s. The VA was part of the *Red de Monitoreo Ambiental*. The *Instituto de Epidemiología y Salud Comunitaria "Manuel Amunárriz"*, is a branch of the health department of the *Vicariato*, with the aims of developing health policies, training health workers and conducting local research.

## **1.5. STRUCTURE OF THE THESIS**

The thesis is divided into three parts broadly reflecting the research process. The first part of the thesis (chapters 2-4) presents the conceptual framework used and how it is applied to the research process. Chapter two presents the characteristics of the conceptual framework: "popular epidemiology". The hypothesis, aim and objectives of the research are presented in chapter three. How the dynamic framework of popular epidemiology was applied to the case of oil exploitation in Ecuador is described in chapter four where the research stages with an overview of corresponding methods and actors are presented.

Studies on the environmental contamination and the health status of women, including outcomes of pregnancies, were conducted as a core component of the popular epidemiology process. Part two of the thesis (chapters 5-7) gives a detailed description and analysis of these studies. Chapter five reviews the literature available on the effect of oil development on environment and health. Chapter six explains the study design and methods used. The results and discussions of these studies are presented in chapter seven.

Part three of the thesis (chapters 8-10) discusses the research process and the relevance of popular epidemiology. Chapter eight discusses practical and personal issues and dilemmas faced during the research process emphasising communication of study findings. Chapter nine locates popular epidemiology in the current debate on epidemiology. It argues that the popular epidemiology approach with its focus on lay involvement and control is essential when securing a key position for epidemiology in public health. The concluding chapter places the study results and research approach in a global perspective arguing the need of alliances between communities and researchers in order to protect health and environment.

# **PART ONE**

## **OIL DEVELOPMENT IN ECUADOR: A CASE FOR POPULAR EPIDEMIOLOGY**



## **CHAPTER TWO**

### **THE FRAMEWORK: POPULAR EPIDEMIOLOGY**

Recent decades have seen an increasing recognition that health is more than an absence of disease; it is a result of a complex mix of social, economic, political and environmental factors all of which reflect complex issues of power, status and resource distribution (Schaefer, 1993). Concerns have been raised that public health may be failing to provide the conditions in which people can be healthy. Numerous studies suggest that despite public health measures, socio-economic divisions within and between countries are widening (Wilkinson, 1996; Kunst, 1997; Acheson, 1998; Berkman and Kawachi, 2000; Leon and Walt, 2000). Beaglehole and Bonita (1997) have argued that public health movements in most countries are heading down a narrow disease focused route under the influence of prevailing social and economic ideology. They have called for a multidisciplinary collaboration, including public participation, extending work from within-population to between-population and the use of qualitative as well as quantitative methods of analysis.

Public health is constituted by a breadth of disciplines, ranging from anthropology, sociology, political science and economics to clinical medicine, toxicology, molecular biology and epidemiology (Savitz et al., 1999). Epidemiology is the field of study of health and disease in populations. As such it is considered to be a basic science of public health, the activity of preventing disease and promoting health in populations (Stone et al., 1996; Krieger, 1999).

Epidemiology became widely recognised with the discovery of tobacco smoking as a cause of lung cancer in the early 1950s (Doll and Hill, 1964). Subsequent decades have seen major discoveries relating to other causes of non-communicable disease such as asbestos, ionizing radiation, and dietary factors (McMichael, 1999). During this period, epidemiology has been the key research tool within public health, other methods being considered as ‘unscientific’ because they did not allow the rigorous control that was possible with many epidemiological methods (Pearce, 1996). Yet, according to Baum (1998), *“many of the problems sought by public health to research are out in the dark, beyond the light that can be shed by epidemiology”*.

Beaglehole and Bonita (1997) have noted that epidemiology has become divorced from public health practice and policy, and controversies over the conceptual framework and methods in epidemiology are currently debated (Savitz et al., 1999; Koplan et al., 1999; McMichael, 1999). This critical reflection has led to calls for a renewed focus on an ecological approach that recognises that individuals are embedded within social, political, and economic systems that shape behaviours and access to resources necessary to maintain health (Wing, 1994; Susser and Susser, 1996; Berkman and Kawachi, 2000) and for a greater community involvement and control of the research process (Wing, 1998; Israel et al., 1998; Arcury et al., 2000). The renewed interest in participatory approaches to public health in the past few years has highlighted popular epidemiology as one of many important approaches to the development of knowledge and action in the field of public health.

This chapter will present the conceptual framework of popular epidemiology. The strengths and limitations of the concept are discussed as well as its potential use as an adequate framework for understanding the research this thesis is based on.



## **2.1. WHAT IS POPULAR EPIDEMIOLOGY?**

Popular epidemiology is a process that includes methodological and conceptual elements of traditional epidemiology but also emphasises basic social structural factors, involves social movements, and challenges certain basic assumptions of “modern epidemiology” (Brown, 1992; Watterson, 1994). Popular epidemiology is not merely a matter of public participation in what we traditionally conceive as epidemiology; it is a question of ownership of the different stages of the research. Popular epidemiology is intended to be of direct and immediate benefit to a community and the research process is under local control (Couto, 1986; Starrin and Svenson, 1991; Arcury et al., 1999).

The essence of popular epidemiology is its commitment to the sharing of power with the people with and for whom researchers work (Brown, 1992; Cornwall and Jewkes, 1995). Popular epidemiology seeks to return the knowledge creation process to ordinary people and, therefore, is committed to assuring that the problem definition arises from within the community and that local people function as cornerstones in the research process (Banner et al., 1995; Matsunaga et al., 1996; Díaz and Simmons, 1999).

Some authors argue that popular epidemiology involves ordinary people in defining research questions, determining methods, analysing data and deciding how research findings could be reported back to communities in a readily comprehensible way. Researchers and local people work together as colleagues with different skills to offer, in a process of mutual learning where local people have control over the process (Brown, 1992; Herbert, 1996; Macaulay et al., 1999).



Popular epidemiology involves scientific, medical and public health experts in varying degrees, but always in alliance with the citizen groups. These groups and researchers are brought together in a dialogue wherein joint discussion, decision making and problem solving are featured. The encounter allows for the development of trust, mutual influence and shared understanding among cooperating parties. Critical thinking is heightened by egalitarian discussion and reflection (Brown, 1983; Starrin and Svensson, 1991; Entwistle et al., 1998; Arcury et al., 2000). Some authors have noted that popular epidemiology is about more than the generation of knowledge, it is a process of learning, development of consciousness, and acting, it is a tool for mobilisation to action through empowerment<sup>8</sup> (Brown, 1983; Gaventa, 1988; Starrin and Svensson, 1991; Travers, 1997; Hecker, 1997; Witten et al., 2000).

Popular epidemiology is more of an attitude or approach than a series of techniques. Popular epidemiology is not related to any particular method although has tended to be associated with qualitative research and quantitative descriptive methods (Arcury et al., 2000). Even randomised clinical trials can be done in true partnership with communities -to maximise community benefits, minimise community harms, and incorporate the social context- while preserving the trials' scientific rigour (Oakley, 1989; Diabetes Prevention Program Research Group, 1999).

There are numerous examples of alliances between local organisations and epidemiologists. For instance, studies documenting the systematic preferential location of toxic waste sites and polluting industries in areas that are predominantly inhabited by poor minorities in the United States of America (USA) (United Church of Christ Commission for Racial Justice, 1987;

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<sup>8</sup> Empowerment defined as *"a social action process that promotes participation of people, organisations, and communities towards the goals of increased individual and community control, political efficacy, improved quality of community life and social justice"* (Wallerstein, 1992).



Mohai and Bryant, 1992, Brown, 1992; Rodeheaver and Cutrer, 1995; Wing, 1998), identifying breast cancer clusters which may be linked to environmental pollution throughout the United Kingdom (UK) (Women's Environmental Network, 1999) or developing models for preventive health for native people in Canada (Herbert, 1996).

Some regions have developed the ideas more than others. In United States, the environmental justice movement have drawn attention to the fact that minority communities and socially disadvantaged persons in society often are burdened disproportionately by environmental hazards such as toxic waste dumps and incinerators, airborne pollutants, contaminated water and pesticide exposure (Alston and Brown, 1993; Coughlin, 1996). In Latin America, popular epidemiology has been developed in the context of community-based health programmes and community initiatives in health care planning and development to bring people together to take back control over their health and raise awareness of the underlying causes affecting their health (Tognoni, 1997; Werner, 2000).

### **2.1.1. The process of popular epidemiology**

Brown (1987), based on Couto's model (1986), has noted the following actors and characteristics that define the process of popular epidemiology:

The *community at risk* is the community and people at risk of environment hazards. The *community of consequence calculation* includes the public and private officials who allocate resources related to environmental health risks. The *community of probability calculation* consists of epidemiologists and allied scientists.



The first stage in Couto's model is "common sense epidemiology". This is where popular epidemiological action begins. The *community at risk* intuitively feels that a higher than expected incidence of disease exists and that this is attributable to pollution. Community residents share information, creating a common perspective. As a result of such judgements, people organise and approach public officials. When citizens organise publicly, they first encounter the *community of consequence calculation*, a community that usually resists them by denying the problem or its seriousness, and even by blaming the problem on the lifestyle and habit of the people at risk (Freudenberg, 1984; Nash and Kirsh, 1986; Ozonoff and Boden, 1987; Blowers, 1993).

A second stage arrives when the *community of consequence calculation* eventually challenges the *community at risk* to provide proof of a danger to human health in order to justify the cost of pollution cleanup or the consequences of a plant closing. This situation might lead the *community at risk* to request help from the *community of probability calculation*, but this level of proof is typically very expensive, even if scientists are available to provide it. Often, in fact, they are neither available nor willing. University faculty often finds that the regular system of academic award and prestige, along with funding pressures, limits their space and time to act in popular epidemiology (Whitehead, 1993; Buchanan, 1996; Chambers, 1997; Israel et al., 1998). For instance, according to Muttitt (1999), instead of applying their academic excellence to the daunting problem of preventing climate change, some of Britain's universities are actually serving as part of the intellectual infrastructure of the oil industry. Oil industry is keen to keep academic institutions on-side, and ensuring that they don't start to question its activities too closely. In order to do this, and in order to maintain their influence over research priorities and course curricula, oil companies provide universities with staff, and donations in both cash and kind.



However, if done, such research can demonstrate the existence of health risks and problems and can spur further investigation (Masterson-Allen and Brown, 1990; Moffatt et al., 1995; Ledogar et al., 1999).

Examples of success collaboration between citizens and the *community of probability calculation* are numerous: in Woburn, Massachusetts (USA), affected families and community activists attempted to confirm the existence of a leukaemia cluster and to link it to industrial toxins that leached into their water supply approaching researchers from Harvard University (Brown, 1992). In Edinburgh, concern on the health effects of damp housing lead to a group of council tenants to ask researchers at the university to investigate these effects. The tenants hoped that scientific evidence would convince the local authority to improve their housing rather than blame their problems on smoking, poor diet or overcrowding (Seymour, 1991). Recently, a community based environmental advocacy group in Harlem (New York) approached researchers at Columbia University to help them determine the possible impact of diesel exhaust on the health of the community (Northridge et al., 1999). In all these studies community members participated actively in the different phases of the research, with varying degrees of involvement, from formulation of the study hypothesis, choice of methods, analysis and interpretation of data to dissemination of the findings, contributing their knowledge of the situation and assuring that the research corresponded to their needs (Mergler, 1987).

In a third stage, community groups might press for corroboration of the findings by official experts and agencies in order to find a solution. In these circumstances, the issue may be taken to court, for blame, organising, and legitimisation (Kimerling, 1995). For instance, affected families of Woburn, Massachusetts, or Lock Haven, Pennsylvania, by industrial



waste contamination put into process a long chain of action which led to a civil suit against corporates responsible of the pollution (Brown, 1987; Leviton et al., 1991).

## **2.2. THE ROLE OF THE POPULAR EPIDEMIOLOGIST**

What is the difference between the role that the epidemiologist has in “conventional epidemiology” and that within the popular epidemiology? The main difference is the popular epidemiologist’s commitment to dialogue with the communities concerned by the study. There is no point in time of this process where the epidemiologist can say that he or she does not want to interact without loosing his/her credibility as a popular epidemiologist. The popular epidemiologist therefore has all tools available to him/her as has any other epidemiologist when it comes to study design and statistical methodologies. He or she however has a further relationship that goes beyond the best use of these tools which is the presence of the communities and / or local organisation as partners at the same level. Both sides have to find a way to communicate in order to make the best use of this working relationship. It is in this relationship that the popular epidemiologist finds a challenge or task that the conventional epidemiologist not is faced with. The conventional epidemiologist might well choose to communicate with the public at times during a study, but it will be when and how he or she chose to do it. In Table 2-1, an ideal-type representation of differences between popular and conventional epidemiology is presented.

Although popular epidemiology has action and social change as its aim, the role of the epidemiologist does not include a social activist role if he or she does not chose to. The epidemiologist might enter into the claim for change and action but will then do so in his or her role as a citizen or member of a community.



**Table 2-1. Popular and conventional epidemiology: a comparison of research characteristics and stages. Source: adapted from Cornwall and Jewkes, 1995.**

	Popular Epidemiology	Conventional Epidemiology
<i>Characteristics of the research</i>		
What is the research for?	Action by local people, with/without external support	Understanding with perhaps action later by external agencies
Who is the research for?	Local people	Institutional, personal and professional interests
Whose knowledge counts?	Local people's and epidemiologist	Epidemiologists
Topic choice influenced by?	Local priorities	Funding priorities, institutional agendas, professional interests
What is emphasised?	Process	Outcomes
<i>Who takes parts in the stages of the research?</i>		
Problem identification	Local people and epidemiologist	Epidemiologist
Data collection	Local people and/or epidemiologist	Epidemiologist
Analysis	Local people and /or epidemiologist	Epidemiologist
Interpretation	Local and disciplinary concepts and frameworks	Disciplinary concepts and frameworks
Presentation of findings	Locally accessible and understandable	By epidemiologist to other academics or funding body
Action of findings	Integral to the process	Separate and may not happen
Who owns the results?	Shared by local people and epidemiologist	Epidemiologist

**2.2.1. Potential problems faced by a popular epidemiologist**

**2.2.1.1. Will involvement cause bias?**

Many epidemiologists and public health officials emphasise various problems in standards of proof in popular epidemiology, ranging from initial detection and investigation to final interpretation of data (Brown, 1992). For epidemiologists and public health officials, disputes over health studies arise from shortcomings in knowledge about exposure and disease.



Epidemiologists and public health officials often focus on problems such as inadequate history of the site, lack of clarity about contaminants' route, determination of appropriate water sampling locations, small number of cases, bias in self-reporting of symptoms, obtaining of appropriate control groups, lack of knowledge about characteristics and health effects of certain chemicals, and unknown latency periods for carcinogens (Brown, 1992).

There is a methodological argument in epidemiological studies that human awareness of a health issue introduces a source of potential bias in any assessment of "health behaviour" which is difficult to control for, compromising the use of self-reports of health status (Rothman and Greenland, 1998). This suggests that the strength of pre-existing local concern about possible health effects of pollution is so great as to predispose a population to think that their health is being harmed.

There is also the potential danger that when the epidemiologist gets involved with the community he/she is working with, he/she might be less rigorous scientifically and might fall into researcher bias or at least might be seen by others to do that. This might jeopardise the validity of his/ her study as well as his/ her own credibility.

#### **2.2.1.2. And if the study shows "nothing"...**

The level of statistical significance required for intervention is also a frequent source of contention among epidemiologists. The pressure of the epidemiologist to come up with some "positive" results if working with local organisations and communities can be difficult to face. The handling of negative results and what they signify might be difficult for the epidemiologist to handle together with the community, resulting in a feeling of being inadequate and not having met the expectations. There are also potential political



consequences as a negative study might be used against the community by companies or others believed to cause damage. This has been done on several occasions by powerful organisations in support of policies that may damage or at the least provide no indication of benefit to the public health (Weindling, 1985; Ritzen and Rosenstock, 1993; Fagin and Lavelle, 1996). The question might be risen if it would be better not to have done any study.

#### **2.2.1.3. Time constraints**

To have a relationship with the community is potentially time consuming. Will the epidemiologist have time to interact? Will this not just increase the workload with little benefit? The epidemiologist might find many reasons related to the extra time needed for not wanting to step into popular epidemiology. Extra time means extra resources and it might be hard to justify time needed for interaction with a community in any epidemiological proposal.

#### **2.2.2. To accept the invitation to enter into popular epidemiology?**

The oil contamination in Ecuador was a potential case for popular epidemiology. *RMA* invited *IESCMA* to work together to assess the potential health impact of oil pollution (see section 1.3). Considering the potential difficulties faced, the choice had to be taken to accept an invitation to enter in a working relationship with those concerned or not.

##### **2.2.2.1. How to deal with bias?**

Popular epidemiology challenges the belief that community participation in epidemiological research introduces bias. Popular epidemiology maintains that conventional epidemiology is also imbued with values, and that the sole researcher perspective is a bias in itself since the research is continually making judgements based on his/her values in terms of what and how they will research (Watterson, 1994; Chambers, 1997; Baum, 1998).



Popular epidemiology shares the philosophy of social science “postmodernist” thinking that argues that knowledge is relative, its understanding depending on a range of social and cultural factors such as media influence, economic interest, political pressure, and social movement activism. Thus, people’s position in society (class and power position, gender, culture) plays a crucial role in their interpretation of events and facts. Postmodernist theory suggests that “discourses” determine how people view the world and are a mechanism for maintaining power within society (Popay and Williams, 1996; Baum, 1998)<sup>9</sup>.

Many epidemiologists uphold the notion of a value-free science in which knowledge, theories, techniques, and applications are devoid of self-interest or bias (Brown, 1992). Popular epidemiology opposes the widely held belief that epidemiology is a value-neutral scientific enterprise which can be conducted in a socio-political vacuum (Pearce, 1996). Popular epidemiology beliefs that to produce a more profound understanding of the situation, it is necessary to involve the public in a constant dialogue.

#### **2.2.2.2 What if the study is “negative”?**

Ozonoff and Boden (1987) have distinguished statistical significance from public health significance, since an increased disease rate may be of great public health significance even if statistical probabilities are not met. Hill (1987) argues that even without statistical significance a strong association may be found based on strength of consistency across persons, places, circumstances, and time; specificity of the exposure site and population; biological plausibility of the effect; and coherence with known facts of the agent and disease. In addition, most studies of risk factors in the general environment show only modestly

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<sup>9</sup> This theory has been strongly influenced by Foucault, who examined the development of the modern institutions of health care (Foucault, 1973) and prisons (Foucault, 1979). He concluded that power in modern society was influenced by the knowledge claimed by groups and how this knowledge comes to dominate discourses.



elevated risks, but these effects may still be important from a public health point of view if large numbers of people are exposed (Pershagen, 1997).

Couto (1986) has observed: *“The degree of risk to human health does not need to be at statistically significant levels to require political action. The degree of risk does have to be such that a reasonable person would avoid it. Consequently, the important political test is not the findings of epidemiologists on the probability of nonrandomness of an incidence of illness but the likelihood that a reasonable person, including members of the community of calculation [epidemiologists], would take up residence with the community at risk and drink from and bathe in water from the Yellow Creek area [a polluted area]”*.

The challenge of making the oil contamination in Ecuador a case for popular epidemiology was taken. The rest of the thesis will be underpinned by the popular epidemiology framework when presenting the case of an epidemiological study exploring the health effects of oil contamination in peasants living in the Amazon basin of Ecuador and how communication between the epidemiologist and the community was dealt with.



## **CHAPTER THREE**

### **HYPOTHESIS, AIM AND OBJECTIVES**

#### **3.1. HYPOTHESIS**

1. Oil contamination of the environment is affecting the health of rural families living in the proximity of oil fields in the Amazon basin of Ecuador.

#### **3.2 AIM**

1. Using a popular epidemiology approach, to investigate if there is a relationship between living in the proximity of oil fields and health in a rural population of the Amazon basin of Ecuador.

#### **3.3 OBJECTIVES**

1. To investigate if oil contamination in water sources used by communities is currently occurring.
2. To analyse the relationship between living in the proximity to oil fields and self reported morbidity in the Amazon basin of Ecuador.
3. To analyse the research process in the light of the popular epidemiology framework.



## CHAPTER FOUR

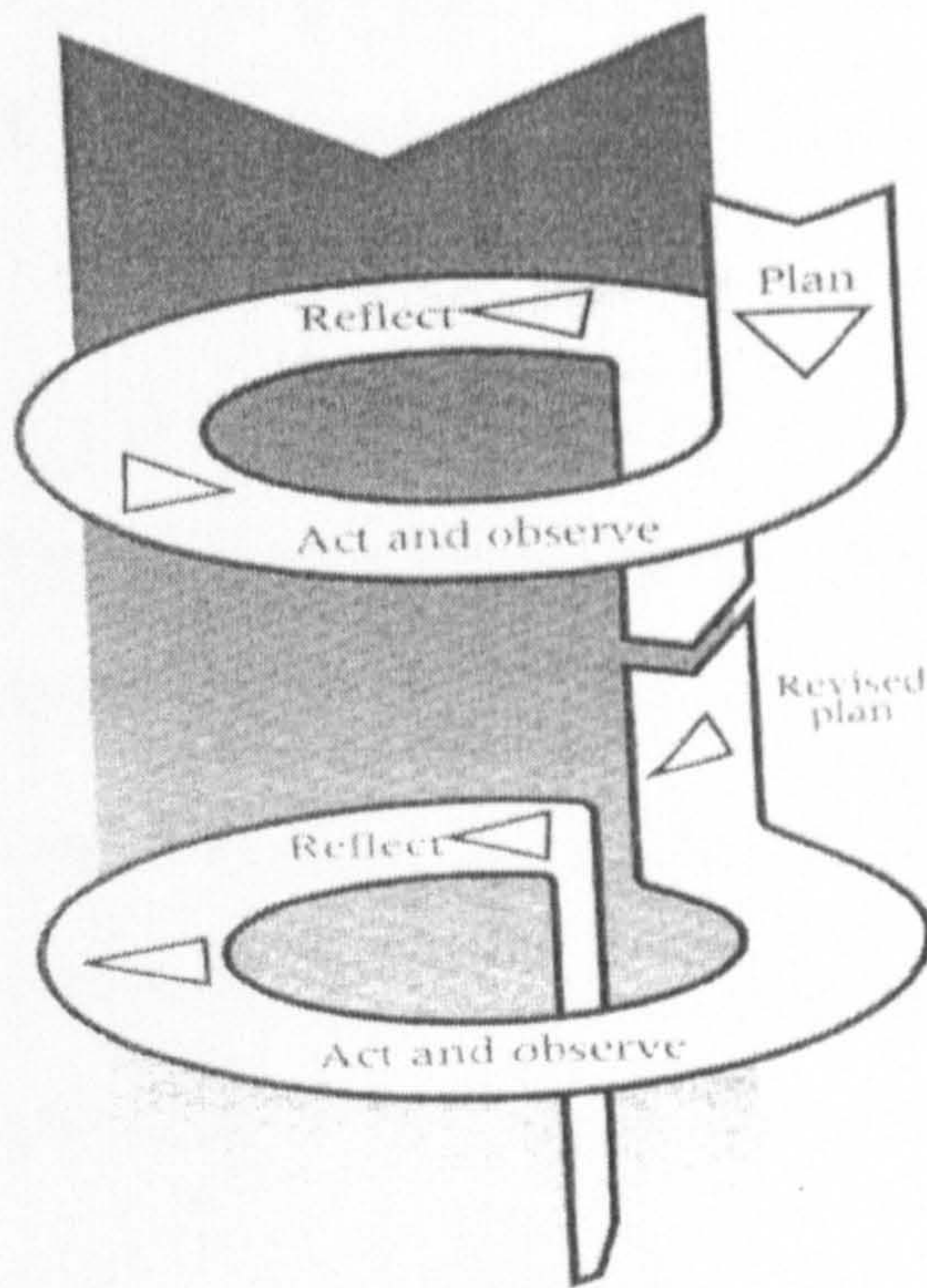
### THE RESEARCH PROCESS

This chapter will present the process of the research and give an overview of methodologies used. The research presented was based on the concern of oil pollution among people and local organisations in the Amazon basin of Ecuador. A relationship between those concerned and the epidemiologist developed and the popular epidemiology framework underpinned the study.

Popular epidemiology is by definition a process where participation is an end in itself. Popular epidemiology is based in the participatory action research approach in which the researchers work explicitly with and for people rather than undertake research on them (Freire, 1972; McTaggart, 1991, Smith at al., 1993; Reason, 1994; De Koning and Martin, 1996; Meyer, 2000). Its aim is to substitute a cyclical on-going process of research, reflection and action for the conventional, linear model of research, recommendation, implementation and evaluation (Cornwall, 1996). Kemmis and McTaggart (1988) describe an action research spiral that is based on the processes of planning, acting, observing and reflecting (Figure 4-1).

A group of people going through this process would start by developing a plan of action, developed from a process of critical reflection, with the intention of improving what is already happening. The plan would be implemented and the process observed within the context in which it occurs. Reflection on these observations would determine the next plan and action, and so on through a succession of cycles (Baum, 1998).





**Figure 4-1. The action research spiral.**

This research is part of one of these cycles. The study formed part of a much longer process of actions taken to change practices of oil companies in this part of the world.

This thesis is based on approximately 20 months of field research that was conducted during three trips to Ecuador: in June 1998, in November 1998 – July 1999 and in March 2000 – December 2000.

#### **4.1. THREE PHASES OF RESEARCH**

The research presented was planned for action, evolving through three overlapping phases (see Figure 4-2):



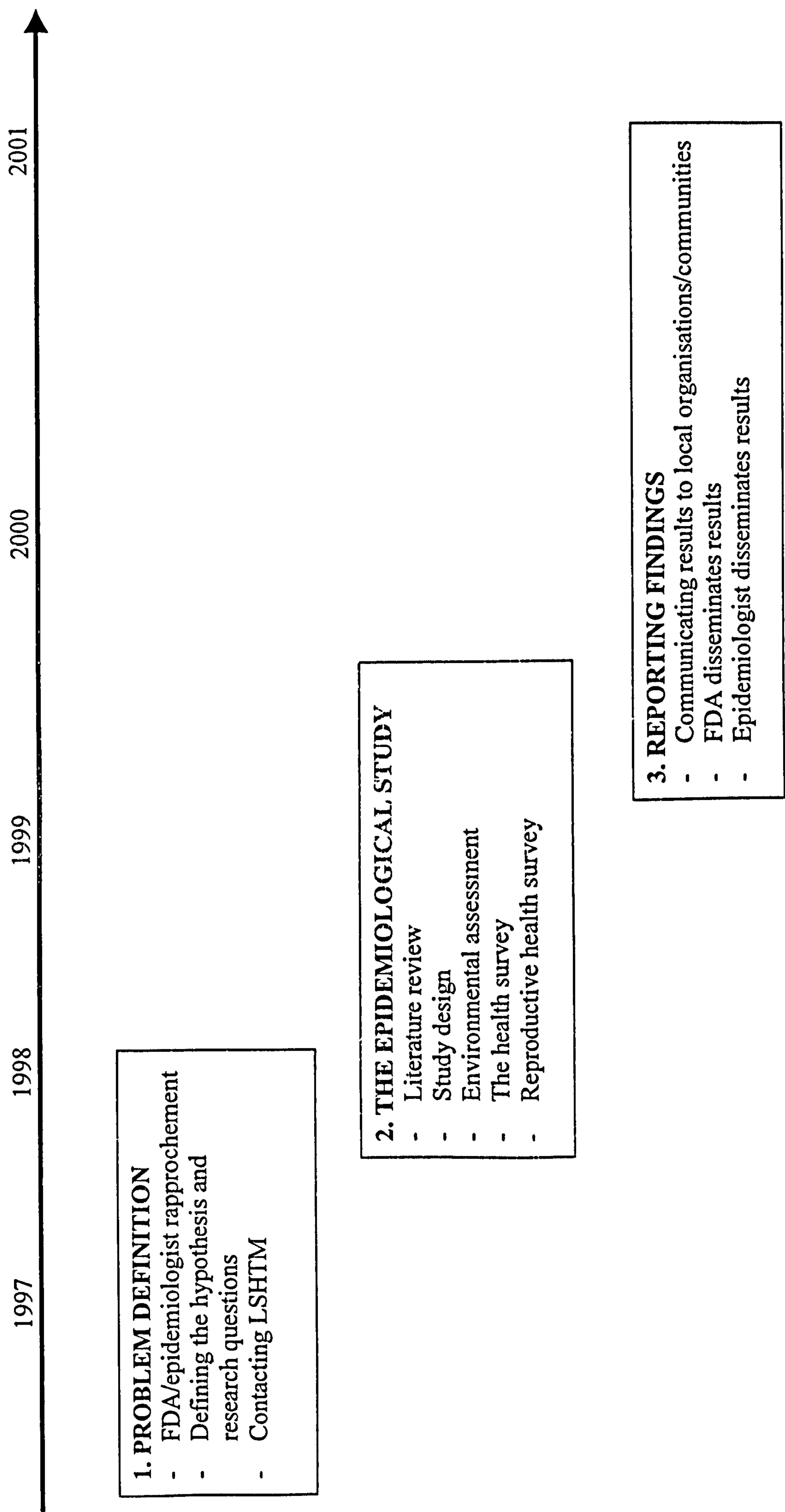


Figure 4-2. Three overlapping stages of the research.



The first phase consisted of problem definition: documenting the problem (oil pollution), identifying the different set of actors involved and examining the process of claim-making (see chapter one).

The epidemiologist has been working in a primary health care program in the Amazon basin of Ecuador since 1990. His main task has been to train community health workers in isolated communities. This programme, funded by a Spanish NGO, *Medicus Mundi Andalucía*, was developed by the *Vicariato de Aguarico* (VA). During his work in communities and local organisations, the epidemiologist became aware of the oil companies and their activities in the area.

Residents of oil producing areas were concerned about the pollution and expressed a wish for better understanding and solutions. These claims were supported by national and international environmental groups. *RMA*, a community grass-root organisation, suspected that oil pollution coming from oil fields was affecting the health of the communities near to them. *RMA* needed evidence about the health and environmental conditions faced by the communities, and an assessment of the possible ways health was being affected by oil pollutants. This would provide information to present to government and oil companies, and they argued that such research could be a tool for mobilisation and action.

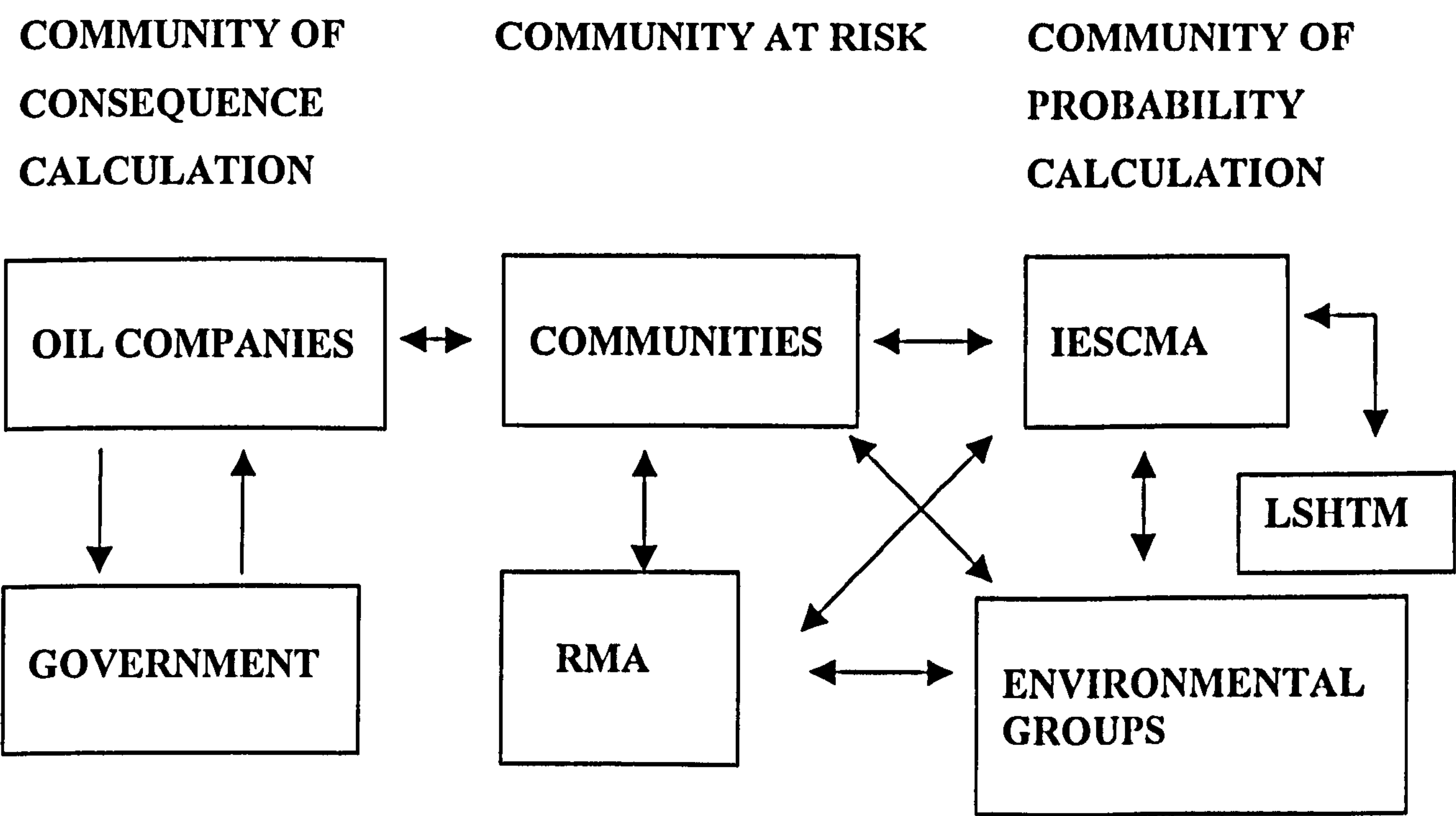
The epidemiologist was part of a medical team forming the *Instituto de Epidemiología y Salud Comunitaria "Manuel Amunárriz"* (IESCMA). He was contacted by the *RMA* to assist in this process. With this in mind, he came to the London School of Hygiene and Tropical Medicine (LSHTM) for a Masters of Science (MSc) course and a proposal was prepared. The *Vicariato de Aguarico* and the *RMA* were consulted and both organisations agreed that the



LSHTM could be an important support, both in the technical and academic aspects of the study.

This proposal developed into a PhD research study at the LSHTM. The research was then organised as a collaboration between the *RMA*, the *IESCMA* and the LSHTM.

The research was a result of interactions between different organisations and institutions. An idealised model of the relationships developed in this first phase is presented in Figure 4-3.



**Figure 4-3.** Interaction among the different actors in the first phase of the research process.

The second phase of the study started with the literature review at LSHTM in order to develop an adequate research design. A preliminary epidemiological design of the study was prepared based on key issues identified from the perspective of the communities and colleagues through their long-term work in Ecuador



In June 1998, the epidemiologist went back to Ecuador to discuss the design and the future implementation with the *VA* and the *RMA*. On arriving he found that organisations within the *RMA* had different ideas about future strategies and the *RMA* network dissolved. The main organisation at the local level left was the *Frente de Defensa de la Amazonia (FDA)*. *FDA* was very interested in the continuation of the study and the process carried on with them as a partner. Smaller independent organisations were formed at this time as a consequence of the *RMA* split. Although *IESCMA* had good relationships with them, *FDA* remained the most suitable to continue the work because of their interest in the research and their extensive network.

*FDA* is an umbrella organisation formed by 20 different peasants and indigenous organisations that represent around 70,000 people. *FDA* has a board composed of four members: president, vice-president, treasurer and secretary, who are elected each two years. *FDA* receives mainly international funds that allow them to have a lawyer affiliated (see section 1.3).

The *FDA* had no money to fund the research and *IESCMA* had to look for money. Initially the epidemiologist sought funds in various organisations in Spain without success. The fieldwork was finally funded by a Spanish NGO, *Medicus Mundi Guipuzcoa (MMG)*. *MMG* is part of *Medicus Mundi Spain*, a federation of regional organisations being each of them independent.<sup>10</sup> The access to the logistics of *VA* and the local community health workers associations was essential.

Overall the study design was accepted and some suggestions incorporated. The research was

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<sup>10</sup> For more information see <http://www.medicusmundi.es>.



designed in order to increase the knowledge and understanding of both the epidemiologist and the local organisations, about the relationship between health and oil pollution. Efforts were done to maintain standards of accuracy, systematise data collection and ensure that the reasoning and interpretation of results were adequate while allowing the research process to retain its essential qualities and its relevance for *FDA* and its organisations. The methodology however, made participants in the study unaware of the hypothesis raised by the *FDA* and denied some affected communities the opportunity to participate. This was initially a problem for the members of the *FDA* Board. Discussions between the epidemiologist and the *FDA* were held in order to clarify expectations and methodological considerations.

The outcomes (see section 6.2) were selected because of the concern expressed by *FDA*. *FDA* communicated to the epidemiologist that communities were concerned over the health impact of oil pollution and perceived it to be associated with: i) an overall ill health -skin rashes, headaches, digestive and respiratory ailments- and, ii) an increased rate of spontaneous abortions. The latter was mainly chosen because of the numerous reports of peasants on cattle abortions, the results of a descriptive study conducted in the area (Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, 1993) and the concern of national environmental groups (Centro de Derechos Económicos y Sociales, 1994). The design and methods of the epidemiological study are presented in chapter 6.

During the data collection, the epidemiologist met a health care worker from a community who was concerned over what she thought was an unusual high number of cancer cases in the village. This led the epidemiologist to investigate this potential high incidence of cancer. This study is presented in chapter seven, section 7.4.



The third phase of the study included the communication and discussion of the results with the *FDA* and the communities. Strategies used to facilitate the dissemination process of the findings were agreed with the *FDA* Board.

The process at this point could not be previously determined, but it was made clear that the epidemiologist would be available for meetings on a local, national and international level. His role at such meetings would depend on the demands.

The main concerns of the *FDA* with the study were related to the timing of the research and the feed-back and ownership of the results. This phase was guided by the following agreements:

- i) Results and conclusions will be discussed with the *FDA* in order to ensure accuracy and avoid misunderstanding.
- ii) Information belongs to the *FDA*. They will be responsible for data dissemination to the communities and other organisations.
- iii) If *FDA* and the communities oppose publication of any of the results (data and/or analyses and interpretations), the *IESCMA* will not publish beyond its reporting requirements as part of a thesis in the LSHTM<sup>11</sup>.

## 4.2. METHODOLOGY

The different stages of the process included different research methodologies corresponding to the objectives of the research (Table 4-1). The methodology to evaluate the environmental conditions and the epidemiological study is described in detail in chapter six. Qualitative

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<sup>11</sup> However, a PhD thesis is in the public domain and the potential consequences were discussed with involved organisations including the LSHTM.



methods were used in order to analyse the research process underpinned by the popular epidemiology framework.

OBJECTIVES	METHODS/DESIGN	TYPES/SOURCES OF DATA
<ul style="list-style-type: none"><li>• To investigate if oil contamination in water sources used by communities is currently occurring.</li></ul>	QUANTITATIVE	Laboratory analysis
<ul style="list-style-type: none"><li>• To analyse the relationship between living in the proximity to oil fields and self reported morbidity in the Amazon basin of Ecuador.</li></ul>	QUANTITATIVE: - Cross sectional	Structured questionnaire
<ul style="list-style-type: none"><li>• To analyse the research process in the light of the popular epidemiology framework.</li></ul>	QUALITATIVE: - Participant observation - Key informant interviews	Meetings Interviews Field notes

**Table 4-1. Study objectives with corresponding methods and data sources.**

Participant observation and key informant interviews were used to collect information on the interaction between the epidemiologist and communities during the research process. Data collection was guided by a quasi-ethnographic style of research based on the principles described by Morgan and Smirchich (1980) and Morgan (1997). It is an approach to research that tries to document and understand the situation being encountered as fully and richly as possible, but is not always able to produce the “thick description” on which pure ethnography is based. The data generated are therefore rougher than those of the ethnographer (Morgan, 1997).

*1. Participant observation*

Observation allows the researcher to study individual and group behaviours, while at the same time capturing the identity and changeability of phenomena related to the research problem.



Through the use of observation, the researcher can also triangulate information and assess the reliability and validity of subjective or objective information through comparative analyses (Boonchalaksi, 1993; De Laine, 1997).

Observation was used generally described as participant observation during the fieldwork (Bernard, 1988). Continuous visits were done to different communities and the epidemiologist participated in frequent meetings held by the *FDA* and the *Centro de Derechos Económicos y Sociales* (CDES). Information was recorded in field notes during and after the observation process.

## *2. Key informant interviews*

Key informants interviews are face to face conversations with people who are relevant, in one or many ways, to the research study and its objectives. The purpose is to explore issues or topics in detail. Pre-set questions are not used, but the interviews are shaped by a defined set of topics or issues (Pope and Mays, 1995).

Key informant interviews were conducted throughout the process in order to ask broad, open-ended questions concerning the different stages of the epidemiological study with special emphasis on the communication process. Interviews were held with leaders of communities, social organizations, environmental groups and health institutions. A list of information sources is provided in appendix 4. Records were taken immediately after or during events on what people said and did, together with personal reflections. Attending local meetings provided insights into organizational behaviour and opportunities for discussions with a range of people.



Participant observations frequently overlapped with the key informants interviews. These interviews became an important and natural part of the popular epidemiology process as they allowed for a continuous discussion with those involved.

#### **4.2.1. Analysis of data**

Qualitative data were textual and comprised a mix of field notes and transcripts from interviews. From these sources of information, the material was sorted and themes were identified to form the basis of the reflection and discussion on the popular epidemiology process (Quinn, 1991; Baum, 1998).

#### **4.2.2. Generalisability of the study**

The research had a strong emphasis on process. The study value lies in the potential to generate an account around an epidemiological study that is relevant for responding to communities' concerns and issues or problems being addressed that can help in managing similar situations elsewhere. The study therefore seeks to create two kinds of generalisability: i) generalisable insights that capture the pattern of events and problems revealed by the case presented and are useful for another settings, and ii) generalisable strategies and tactics through which popular epidemiology can be conducted in similar settings.



# **PART TWO**

## **SEARCHING FOR EVIDENCE**



## CHAPTER FIVE

### OIL, ENVIRONMENT AND HEALTH: THE LITERATURE REVIEW

Traditionally there are two principal sources of information on health effects resulting from exposure to chemicals that have been used in assessing health risks. The first is toxicity studies using laboratory animals and the second one, studies of human populations (Griffith, 1993). The information on health effects resulting from exposure to oil chemicals will be reviewed. First, studies on animals exposed to crude oil, including data from spills will be presented; second, the health impact of the different stages of oil development - exploratory drilling, production, transport - and of major oil spillage will be reviewed (Figure 5-1).

A summary of the hazards produced in the different stages of the oil development and its potential environmental and health impacts, and affected groups is shown in Table 5-1. Some cross cutting impacts related to oil production activities are presented in appendix 5. A brief review of studies assessing the health impact of being exposed to pollutants from the petrochemical industry is presented in appendix 6.

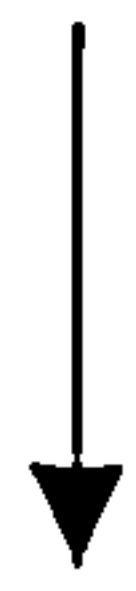
#### 5.1. ANIMAL STUDIES

##### 5.1.1. Laboratory animals

Toxic effects. Studies in birds have shown that the primary target of oil toxicity is the peripheral red blood cell, but that significant stress-related lesions (such as lymphocyte depletion in primary lymphoid tissues) were also associated with ingestion of oil (Leighton, 1986). Administration of crude oil has resulted as well in functional changes in rats liver



1. EXPLORATORY ACTIVITIES: seismic studies



2. DRILLING of EXPLORATORY WELLS

\* drilling muds, industrial chemicals → OPEN PITS



3. PRODUCTION

\* GAS → BURN

\* FORMATION WATER



\* CRUDE OIL



4. TRANSPORT : pipeline → SPILLS



5. REFINERY

Figure 5-1. The different stages of the oil development process.



Table 5-1. Hazards, potential environmental and health impacts and primary groups affected in the different stages of oil development.

STAGE	HAZARDS	ENVIRONMENTAL IMPACT	PRIMARY GROUPS AFFECTED	HEALTH IMPACT
Exploratory	Trails construction Explosions	Deforestation Wildlife reduction	Workers Communities	Communicable diseases Malnutrition
Drilling	Testing wastes Oil wastes Air pollution	Aquatic toxicity Terrestrial toxicity Human toxicity Global warming	Communities Fishermen Children and women	Non-communicable diseases Cancer Respiratory diseases Workers Injuries
Production	Toxic wastes Formation water Air pollution	Resource depletion Aquatic toxicity Terrestrial toxicity Human toxicity Global warming	Communities Fishermen Children and women Workers	Non-communicable diseases Cancer Respiratory diseases
Transportation	Road construction Spills	Deforestation Wildlife reduction Aquatic toxicity Terrestrial toxicity Human toxicity	Communities Fishermen Children and women Workers	Communicable diseases Non-communicable diseases Malnutrition Traffic accidents
Refinery	Toxic air emissions Toxic wastes	Aquatic toxicity Human toxicity Global warming	Workers Residents	Non-communicable diseases Cancer Injuries



mitochondria (Khan et al., 1986) and in inhibition of some testicular development with lower concentration of androgens in plasma in salmon and flounders (Truscott et al., 1983).

Cancer. Several studies have reported skin tumours in mice after application to the skin of crude oil (McKee et al., 1986; Clark et al., 1988; Wilson and Holland, 1988). However, a review about experiments in animals concluded that there is limited evidence for the carcinogenicity of crude oil (International Agency on Research Cancer, 1989).

Effects on reproduction. Crude oil administered orally to pregnant rats decreased fetal weight and length (Schreiner, 1984) and multiple exposure also caused a significant reduction in maternal body weight (Khan et al., 1987). Several studies have demonstrated pronounced effect of crude oil on the reproductive capacity of birds (deformed bills, incomplete ossification and feather formation, dead embryos) after application on the shell surface or after oral administration (Hoffman, 1979; Lee et al., 1986; Walters et al., 1987; Feuston et al., 1997).

### 5.1.2. Wildlife

Fish. Different studies carried out in contaminated marine sites have shown the presence of crude oil in different species of fishes (Lockhart et al., 1992; Hellou et al., 1994). The implications of these contaminants for the northern ecosystems and the people dependent upon them are still not clear. Effects of the crude oil from oil fires in Kuwait resulted in a significantly reduction on survival and growth of the marine fish *Menidia beryllina* (Al Yakoob et al., 1996).



Birds. There is much evidence that oil spills are responsible for massive seabird deaths (Rebar et al., 1995; Briggs et al., 1996). Data from studies after oil spill have also reported respiratory distress in moulting grey seals (Hall et al., 1996) and haemolytic anaemia in sea ducks suffered induced by ingestion of oil (Yamato et al., 1996).

Mammals. Significant differences in levels of blood haptoglobin and body mass occurred between river otters (*Lutra canadensis*) inhabiting oiled and non-oiled areas of Prince William Sound, Alaska (USA) following the Exxon Valdez oil spill in 1989, and oil-related causes were proposed for these differences (Duffy et al., 1993). Increased mortality has been reported in seals following oil spills in the North Sea (Jenssen, 1996).

In oil producing areas, the proximity of livestock to drilling operations and production sites often results in poisoning of animals from ingestion of crude oil, salt water, heavy metals, and caustic chemicals. The most common cause of illness or death following exposure to petroleum hydrocarbons is aspiration pneumonia, which may cause a chronic progressive deterioration of health, with death after several days or weeks (Edwards, 1989; Coppock et al., 1996).

## **5.2. HUMAN STUDIES**

### **5.2.1. Exploratory stage**

No literature was found about the health effects of the exploratory stage. However, in the context of Ecuador, work-related illnesses such as skin and gastrointestinal diseases are common (personal observation).



Yellow fever spread to several workers (one death) from forest penetration due to inadequate vaccine protection (personal observation, 1997). Many workers are indigenous and their entry into the migratory work force has disrupted traditional family life and triggered epidemics of influenza, malaria, hepatitis and venereal diseases in their communities (Amunárriz, personal communication; El Comercio, 1999b).

### **5.2.2. Drilling / Production**

As noted in chapter one, activities associated with petroleum production provide a variety of air and water pollutants and hazardous wastes. Communities living near oil fields are likely to suffer exposure to chemicals and toxics when they breathe, use water for drinking, bathing or cooking, or eat food in contact with toxic materials.

Oil pollutants can be deposited in soil or taken up by aquatic organisms in amount that may have adverse health effects and increased malnutrition rates, especially in children and subsistence fishermen, when contaminated fish or their products enter the food chain (Saxton et al., 1993; Tchounwou et al., 1996).

Few studies have been conducted in petroleum exploration and producing workers. In one of two case-control studies, an excess risk for testicular cancer was observed among petroleum and natural gas extraction workers (Mills et al., 1984). No such excess was found in the other study (Sewell et al., 1986). In a case-control study of cancer at many sites, an association was observed between exposure to crude oil and rectal and lung cancer, however the association was based on small numbers (Siemiatycki et al., 1987). A study carried out in producing and pipeline workers in USA did not find significant differences for all major causes of death (Divine and Barron, 1987). Sathiakumar et al (1995) conducted an epidemiological study in



oil and gas field workers in USA that showed a positive association between work and acute myelogenous leukaemia. A study from China also reported high incidence of leukaemia in oil fields workers (Yang and Zhang, 1991). A recent update of a study of crude oil production workers showed a lower mortality risk for these employees compared with the general United States population. An increased mortality from acute myelogenous leukaemia was found in those people who were first employed before 1940 and who were employed in the production of crude oil for more than 30 years (Divine and Hartman, 2000).

Drilling and production also carries a significant risk of injury. Injuries could occur through drowning, falls, inappropriate disposal of sharp materials or failure to use personal protective equipment even when it is made available to them (McNabb et al., 1994). Furthermore petroleum industry exposes workers to high noise level from drills, compressors, generators, pumps and valves (World Health Organisation, 1992).

At this point, three groups of chemical exposure deserve a further specific explanation.

#### **5.2.2.1. Crude oil**

Crude oil has been defined as a very complex mixture, mainly composed of paraffinic, cycloparaffinic, naftenic and aromatic hydrocarbons, and traces of other elements, including a number of metals. Among the crude oil components identified, the aromatic petroleum hydrocarbons of toxicological interest are benzene, alkyl-benzenes (principally toluene and xylene) and polynuclear aromatic hydrocarbons (PAH) (International Agency on Research Cancer, 1989).



Recognised human responses associated with acute exposures are mainly transient and short lived unless the concentrations of components are unusually high. Such exposures irritate the skin, cause stinging or redness of the eyes on accidental contact or exposure to the vapours, and can produce nausea, dizziness, headache, or drowsiness on prolonged or repeated exposure to low concentrations of their volatile components (Campbell et al., 1993). Inhalation of mineral oils may cause lipoid pneumonia and death (Rodríguez et al., 1991).

Areas of particular concern include exposure to benzene, toluene, and xylene. High concentrations of benzene cause neurotoxic symptoms, and prolonged exposure to toxic levels may cause bone marrow damage with persistent pancytopenia (McMichael, 1988). In addition, benzene is established as a cause of leukaemia (Wong, 1987; Austin et al., 1988), and perhaps other hematologic neoplasms and disorders<sup>12</sup> (Hayes et al., 1997; Savitz and Andrews, 1997).

The primary health effects of toluene and xylene are on the central nervous system. No adequate data on the incidence of cancer after human exposure to these volatile organic chemicals exist. A population-based case-control study carried out in Montreal showed limited evidence of increased risk for the following associations: esophagus-toluene, colon-xylene, rectum-toluene, rectum-xylene and rectum-styrene (Gerin et al., 1998). An ecological study performed to examine the relation between the incidence of leukaemia and the occurrence of volatile organic chemical (VOC) contamination of drinking water supplies suggested that drinking water contaminated with VOCs might increase the incidence of leukaemia among exposed females (Fagliano et al., 1990). Epidemiological studies have

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<sup>12</sup> Due to its high carcinogenic potency and its relatively long environmental persistence, benzo[a]pyrene (BaP) appears to be the most important risk as well as the most relevant indicator for benzene. Adequate data upon which to base a quantitative assessment of the carcinogenicity of ingested PAHs are available only for BaP (Attias et al., 1995; World Health Organisation, 1996).



reported direct evidence of the carcinogenic effects of PAHs in occupationally exposed subjects. Strong evidence exists of carcinogenic effects of PAHs on the skin, bladder and scrotum (Everall and Dowd, 1978; International Agency on Research Cancer, 1983; Bonassi et al., 1989; Mastrangelo et al., 1996; Boffetta et al., 1997). Workers in several industries with significant PAH exposure have also been shown to be at risk of lung cancer (International Agency on Research Cancer, 1983; Nadon et al., 1995; Mastrangelo et al., 1996; Boffetta et al., 1997).

No conclusive evidence of teratogenic potential or for reproductive effects has been found for benzene, toluene or xylene (Campbell et al., 1993).

#### **5.2.2.2. Other chemical exposures**

Oil companies in Ecuador have not made chemical data about their drilling wastes available to the public. Data from the United States, however, show that drilling wastes can typically contain significant amounts of a wide range of toxic pollutants, including antimony, arsenic, cadmium, chromium, copper, lead, magnesium, mercury, nickel, zinc, benzene, and other hydrocarbons, as well as toxic levels of sodium and chlorides (Kimerling, 1991).

The heavy metals of concern for health with regard to oil pollution exposure through drinking water are mercury and cadmium. Exposure to mercury can occur through contamination of surface or groundwater and consumption of fish (Boischio and Henshel, 1996). Similarly, short-chain alkyl mercury compounds are lipid-soluble and volatile; therefore they pose a risk of skin absorption and inhalation from bathing in contaminated waters (Hu and Kim, 1993).

The most common symptoms of high-level organic mercury poisoning are mental disturbances, ataxia, gait impairment, disturbances of speech, constriction of visual fields, and



disturbances of chewing and swallowing (Moreira, 1996). The toxicological implications of low-level mercury exposure are poorly understood.

Cadmium accumulates throughout life. Environmental exposure to cadmium can occur, as in the case of mercury through water use and food consumption. One study in Japan has shown that individuals who consumed cadmium-contaminated rice developed chronic cadmium poisoning and had shortened life spans (Nakagawa et al., 1990). High cadmium consumption causes nausea, vomiting, abdominal cramping, diarrhoea, and kidney disease (Kido et al., 1990). Recent studies have suggested an increase rate of mortality from lung cancer in workers exposed to cadmium (Sorahan and Lancashire, 1997). Studies have also indicated an association between occupational exposures to cadmium and prostatic cancer (Waalkes and Rehm, 1994; Sharma-Wagner et al., 2000).

#### **5.2.2.3. Air pollution**

Air pollution is a common consequence of oil activity with chemical or physical agents. The extent to which air pollutants emitted by industry pose a risk to the general population depends on a number of factors; some of these include the hazard and the amount of the compound released, the atmospheric conditions, number of people and susceptibility.

Although quantitative data on air emissions from oil operations is not available in Ecuador -at least to the public- an internal study conducted in 1990 by the national oil company found high levels of air pollution in its concession (Kimerling, 1991).

Burning oil and gas pollutes the air with oxides of nitrogen, sulphur, and carbon, as well as heavy metals, hydrocarbons, and soot, or carbon particulate matter. Many of these emissions



are toxic, and nitrogen oxides can react with sunlight to form ozone, a human respiratory irritant.

Common symptoms associated with ozone exposure include cough, phlegm and dyspnea. Sulphur dioxide and particulates have a clear effect on airway function and there is experimental evidence that nitrogen oxides affect the resistance to infection including the immune system (Wegman, 1996). Different epidemiological studies have confirmed the association between these pollutants and respiratory morbidity, particularly in patients with asthma (Bates and Sizto, 1989; Pinter et al., 1996; Voight et al., 1998; Ostro et al., 1999; Chew et al. 1999; Tolbert et al., 2000; Roemer et al., 2000). Numerous studies have also shown a positive association between mortality and outdoor air pollution (Salinas and Vega, 1995; Pereira et al., 1998; Bremner et al., 1999; Saurina et al., 1999; Loomis et al., 1999; Abbey et al., 1999).

The best described human health risk associated with carbon monoxide exposure is that of acute over exposure resulting in fatal poisoning. There is also evidence that chronic overexposure is associated with increased cardiovascular events as well as increase in anginal pain (Stern et al., 1988; Wegman 1996).

In addition to these pollutants, populations exposed to PAH might be at risk of lung, skin, scrotal and bladder cancer (International Agency on Research Cancer, 1987; Mastrangelo et al., 1996; Boffetta et al., 1997; Ronneberg et al., 1999). VOCs have been related to adverse respiratory effects (Ware et al., 1993; Deloraine et al., 1995).



### **5.2.3. Transport**

Without regard for natural drainage patterns during road construction, pooling of water is inevitable. Malaria mosquitoes proliferate in the surface waters and the transmission of malaria may be intensified. In 1974, some 50% of the malaria in the Amazon of Brazil was linked to the narrow area of influence of the Trans-amazon highway (Coimbra, 1988).

Most of the roads are unpaved and large volumes of dust disturbed by traffic may cause respiratory diseases (Howze and Hughes, 1990). Where oil-coated roads, pervasive smell and rashes on people who walk barefoot are common.

There appears to be a strong link between development and motor-vehicle related mortality (Ezenwa, 1996). In the roads of the “Oriente”, traffic accidents are numerous, becoming the second cause of mortality in the small towns (United Nations Children’s Fund, 1992).

### **5.2.4. Oil spills**

Epidemiological investigations of major oil spillage have been undertaken infrequently and have been focused on workers involved in cleanup operations rather than exposed residents, and performed only at later stages in the incidents (Gorman et al., 1991).

A study carried out after the Exxon Valdez oil spill in 1989 suggested increased prevalence of anxiety disorders, posttraumatic stress disorder and depressive symptoms in Alaska communities one year after the spill occurred. Women and Alaska natives were particularly vulnerable to these conditions (Palinkas et al., 1993).



The principal health effects found in studies on acute exposure to crude oil have been headache, throat irritation, itchy eyes and tiredness (Campbell et al., 1993; Lyons et al., 1999). A follow up study of one of these studies reported significantly higher scores on the general health questionnaire and tiredness in the exposed group (Campbell et al., 1994).

Recently, a study conducted on residents involved in cleanup activities after an oil spill in Japan reported an increase on back and leg pain, headache and symptoms of eyes and throat after the beginning of the cleanup activities (Morita et al., 1999).

Studies have shown that animals experience adverse health effects when exposed to oil chemicals. There is a lack of information on the health impact of oil development activities in residents living near oil fields. Yet literature has shown the potential health effects at the different stages of oil development.

The following chapter will present the study design and methods used to assess the health impact of oil pollution in peasants living in the proximity of oil fields in the Amazon basin of Ecuador.



## CHAPTER SIX

### THE EPIDEMIOLOGICAL STUDY: DESIGN AND METHODS

#### 6.1. STUDY AREA AND POPULATION

This research has been carried out in communities of peasants situated in the Fco. de Orellana and Sachas districts of the Orellana province, and in the Shushufindi district of the Sucumbíos province, both in the north-eastern part of Ecuador. This area was chosen because of the local concern and the long term and high density of oil-drilling activities (Figure 6-1).

Peasants are organised in small communities (*pre-cooperativas*) where each peasant owns around 30 hectares of land. In this region, they number approximately 50,000. Most of them arrived to the area in the 70s following the paths opened by the oil companies. They make their living mainly by agriculture and cattle-raising.

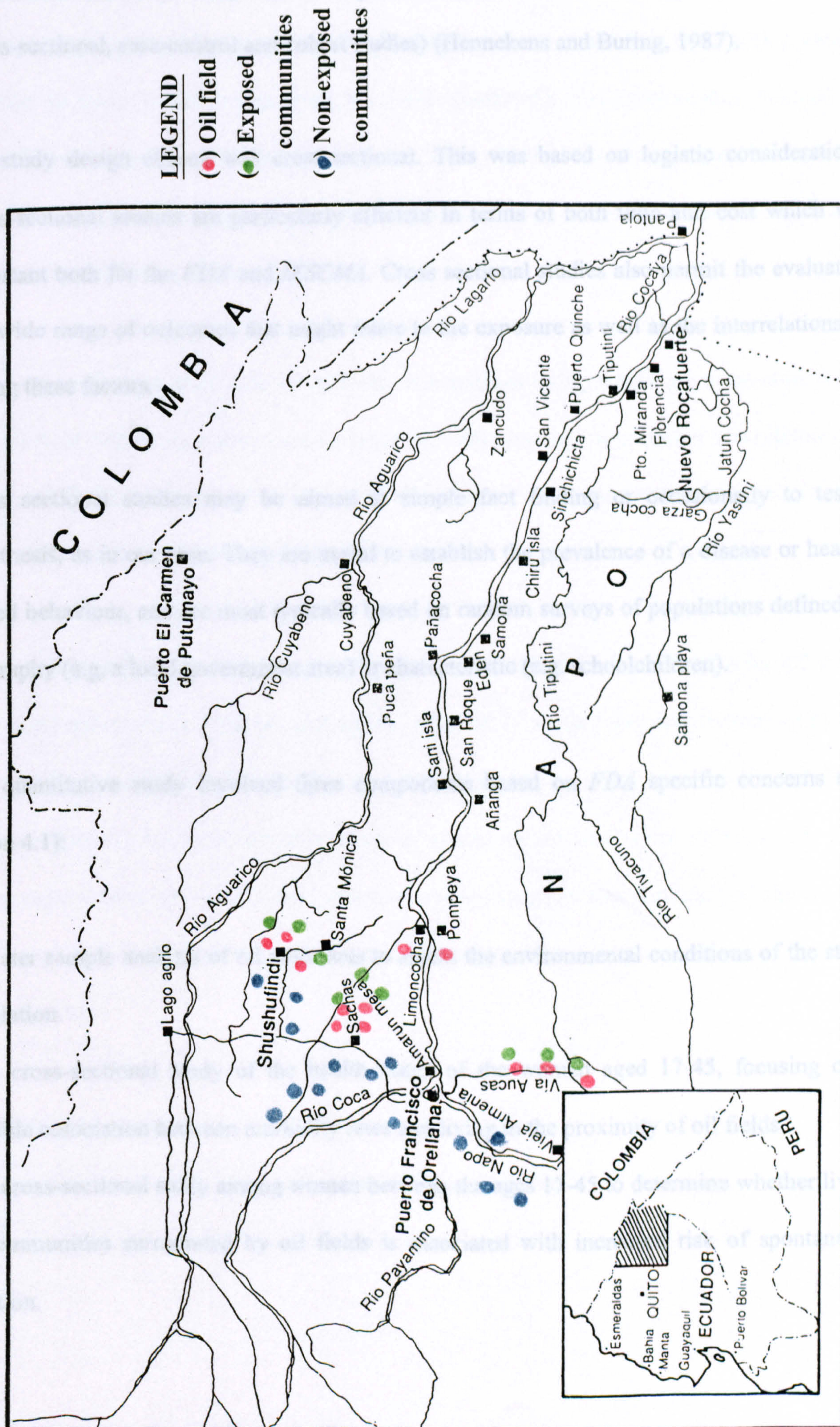
Many of them live in the surroundings of oil production facilities. Most communities in the area lack electricity, piped water supply and have difficulties to access health services (see results section 7.2.1.4).

#### 6.2. TYPE OF STUDY

For several considerations - state of knowledge, real world opportunities, logistics and costs, and ethical considerations - there is a rich repertoire of study designs available to epidemiologists. The main types of epidemiological research design are: experimental studies



Figure 6-1. Map of the study area, northeaster region of Ecuador (source: Amunárriz, 1991).





(randomised controlled trial) and non-experimental, which can be descriptive and analytical (cross-sectional, case-control and cohort studies) (Hennekens and Buring, 1987).

The study design chosen was cross-sectional. This was based on logistic considerations. Cross-sectional studies are particularly efficient in terms of both time and cost which was important both for the *FDA* and *IESCMA*. Cross sectional studies also permit the evaluation of a wide range of outcomes that might relate to the exposure as well as the interrelationship among these factors.

Cross sectional studies may be aimed at simple fact finding or occasionally to test a hypothesis, as in our case. They are useful to establish the prevalence of a disease or health-related behaviour, and are most typically based on random surveys of populations defined by geography (e.g. a local government area) or characteristic (e.g. schoolchildren).

The quantitative study involved three components based on *FDA* specific concerns (see section 4.1):

1. Water sample analysis of oil pollutants to assess the environmental conditions of the study population.
2. A cross-sectional study of the health status of the women aged 17-45, focusing on a possible association between morbidity rates and living in the proximity of oil fields.
3. A cross-sectional study among women between the ages 17-45 to determine whether living in communities surrounded by oil fields is associated with increased risk of spontaneous abortion.



### 6.3. SELECTION OF COMMUNITIES

Two groups of communities were selected for the study: communities in areas with potential exposure to toxic contaminants from oil fields (exposed), and communities selected as “control” area (non-exposed). The communities in the control area comprise people who have socio-demographic and geographical characteristics similar to those in the exposed area (Cabodevilla, 1997).

Exposed communities were defined as those communities living within a 5 kilometres (km.) of an oil field, following a downstream direction. Non-exposed communities were defined as those located at a minimum of 30 km. upstream from oil fields (see Figure 6-2). All studied communities were away from other chemical industries.

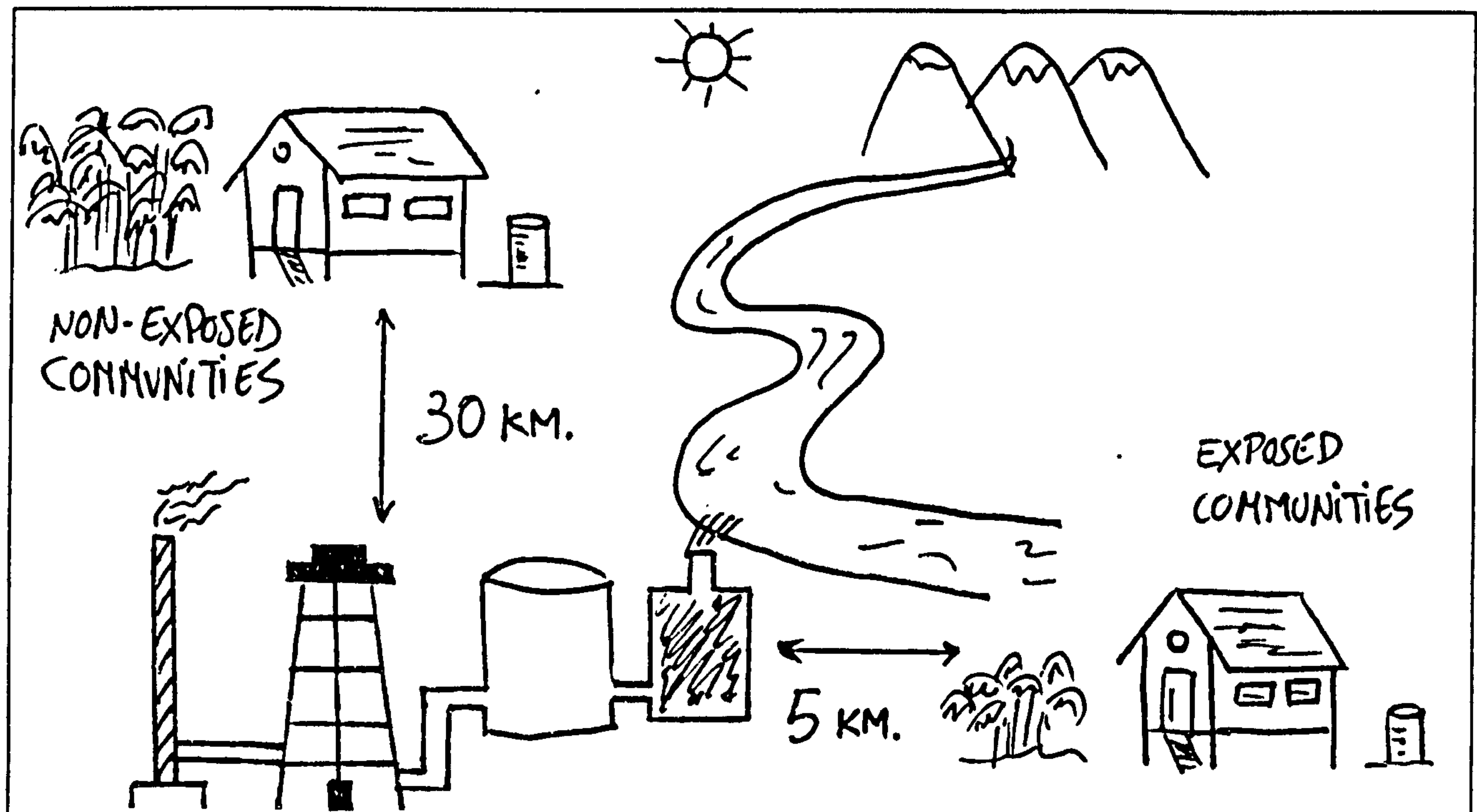
The target population was women aged 17 to 45 years resident for a period of at least 3 years in the study communities. This population was selected: i) because they were identified by the epidemiologist and *FDA* as one of the most vulnerable groups to oil exposure through their daily activities, ii) they were easier to contact because of the local work activities, iii) they were at reproductive age (one of the outcomes was spontaneous abortion) and, iv) the criteria of living at least 3 years in the same community was chosen as a proxy measure for “long term” exposure.

#### 6.3.1. Selection of sample

A community was defined as the group of families that form a *pre-cooperativa*. All communities consist of several families, with a total population of around 100-400.



The sampling method used was a two-stage sampling procedure. Initially, a list of communities was prepared, being stratified in exposed and non-exposed. Nine exposed and fourteen unexposed communities were selected randomly and all women aged 17 to 45 years old who have lived for at least 3 years in the selected community were included.



**Figure 6-2. Location of upstream and downstream communities regarding to an oil field.**

Community leaders were used to identify women who met the eligibility criteria for age and length of residence and asked these women to participate in the study.

### **6.3.2. Sample size requirements**

The sample size calculation was based on the number of women aged 17-45 years required in order to detect a double difference between the exposed and unexposed group at the 5% level with 80% power, assuming a 20% prevalence in the unexposed population. The sample size



was doubled to adjust for the clustered nature of the sampling. The calculations were based on the Epi-Info 6 program. This gave a requirement of 182 women per group.

To allow for a 70% participation, the sample size was increased to 260 for each group to obtain a more realistic estimate.

In relation to the study of reproductive outcomes, the sample size calculated was the required number of outcomes to detect a double difference in spontaneous abortion prevalence between the exposed and unexposed group of communities, also with a 80% power at 5% significance level. It was calculated using the baseline prevalence of spontaneous abortion as 10% reported by a local community study for females living in the “Oriente” (Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, 1993).

From these premises, a sample size requirement of 1,251 pregnancy outcomes was calculated based on the same considerations about the planned cluster nature of the sampling and possible non-participants during the study period. To reach that number, the last 3 pregnancies of the previous sample of females were used. Calculations of the sample size were based on the Epi-Info 6 statistical computer package.

## **6.4. FIELD WORK**

### **6.4.1. Environmental assessment**

There were multiple sources of environmental contamination to measure. Logistic constraints led the epidemiologist to measure only water contamination.

To assess if the communities surrounding oil fields were exposed to this kind of pollution, water samples of the places used by the community for drinking, bathing or washing clothes



were collected. The water analysis included total petroleum hydrocarbons (TPH) and was carried out by the Water and Soil Laboratory of the P. Miguel Gamboa Technical School, Coca. The method to measure TPH comprised extraction with 1,1,2-trichlor-trifluor-ethane and determination by infrared spectrophotometry (limit of detection 0.001) (Zehner and Villacreces, 1998). Special bottles for water sample taken were provided by the laboratory. Laboratory technicians were kept blind to the water origin.

During the months of February to April of 1999, samples of different rivers used by the exposed and non-exposed communities were collected. The samples were taken in winter season without visible crude oil presence in the rivers. Twenty streams from the 9 exposed communities and two streams from the non-exposed communities were investigated. Existing data from water analysis reports from the area were also reviewed.

#### **6.4.2. Questionnaire**

A structured questionnaire was developed for administration to the female head of the household. The questionnaire comprised three parts:

- i) the first part had information on demographic details (age, ethnic group, length of residence, marital status) and socio-economic characteristics (educational level, female occupation, husband occupation and living conditions);
- ii) the second part contained information on the medical history of the women. Their personal medical history in the past 2 weeks and during the past 12 months and their use of medical services was recorded. Definitions of symptoms were not given and clinical examinations



were not performed. This part was adapted from other community studies (Spitzer et al., 1989; Campbell et al., 1993);

iii) the third part included information on the last three reproductive histories of the women occurring during the period of residence in that community. Information was obtained on the number of pregnancies to the time of interview, the outcome (live birth, spontaneous abortion, and stillbirth) over the last 3 pregnancies, the date and gestational age at the end of each pregnancy and, whether liveborn children were still alive. The last three recent pregnancies were selected to maximise recall of pregnancy and exposure information. Smoking habits, medication taken and diseases during pregnancy were also investigated. This part of the questionnaire was adapted from Doyle et al (1997).

The women selected for the study were asked to participate in a personal interview. The study was presented as a health status survey. A date for the study was arranged and women agreed to be interviewed in the centre of the community. Respondents were interviewed in a private room of the school or the community centre.

The questionnaire, in Spanish, took approximately 30 min. to administer. The questionnaire is available in appendix 7. The questionnaire was administered by one trained local field worker (part 2 of the questionnaire) and the researcher (part 1 and 3). Details of recruitment and training are given in section 6.6.

The questionnaire was piloted in one community of the area to identify problems in the wording of the questionnaire and timing. The results of the experience were discussed and the necessary changes made.



### **6.4.3. Definition of variables**

#### **6.4.3.1. Definition of explanatory variables**

- a) demographic characteristics comprised age, ethnic group (*mestizo*, black, indigenous) and marital status (single, married, widow).
- b) socio-economic characteristics comprised female education, female occupation, husband occupation and living conditions.

Education was recorded as a categorical variable: 0, never went to the school; 1, did not complete the primary school; 2, completed primary school; 3, did not complete secondary school and, 4, completed secondary school.

Female occupation was arranged in two categories as follows: agriculture and other (housewife, shopkeeper, teacher).

The occupation of the husbands was categorized in four groups: agriculture, oil company, palm company workers and other (trade, business, and teacher).

Housing conditions were measured through three items:

- building material of the house: cement / other (wood, palm)
- possession of a fridge: yes/ no
- possession of a latrine: yes/no

#### **6.4.3.2. Definition of health status outcomes**

The personal medical history in the past 2 weeks and during the last year was recorded by personal interview. Participants answered the question: “Have you had any of these symptoms in the past 2 weeks? Have you had any of these symptoms in the past 12 months?” and a list of symptoms was enumerated. The list of symptoms was based on other population studies



under similar exposure (Campbell et al., 1993; Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, 1993).

A recall period of two weeks has been recommended as a reasonable compromise for most health surveys' variables (Ross and Vaughan, 1984). In our study, despite the potential bias, a recall period of 12 months was also chosen. The reason behind this criterion was the assessment of symptoms prevalence in a longer period since people have suffered a long-term exposure to oil pollution.

#### **6.4.3.3. Definition of reproductive outcomes**

Pregnancy outcomes were recorded according to the following definitions: (i) pregnancy was defined as the delayed "period" perception by the subject more than 3 months from the last period, (ii) spontaneous abortion was used to describe fetal loss at 28 weeks gestation or earlier, (iii) stillbirth was defined as a fetal loss after 28 weeks of gestation, but without any evidence of life at birth and, (iv) a full term baby was one born alive after the 36th week of gestation (Schnorr et al., 1991).

Only pregnancies that ended before December 31, 1998 and occurred during the residence of the women in the communities were included. Only self-reported miscarriages were considered in the study due to the lack of hospital records or medical attendance. Elective abortions, multiple pregnancies and pregnancies of women having use an intrauterine device at the time of conception were excluded from analyses because of the high rate of spontaneous abortion among women who become pregnant while using the latter method of contraception (Kline et al., 1989; Stücker et al., 1990; Schnorr et al., 1991).



## 6.5. DATA HANDLING AND ANALYSIS

All the forms used were precoded. All the data were checked for completeness and coding accuracy before the computer entry. Data were entered into a microcomputer in the field after each day of work using the Epi-Info version 6 programme.

After data entry, consistency checks were performed and the data were cleaned. Computations were performed with Epi-Info 6 statistical package and Stata version 6.

Prevalence odds ratios (PORs) for each self-reported symptom were calculated with 95% confidence intervals (CI). Prevalence odds ratios adjusted for potential confounders (age, women and their husbands' occupation and living conditions) were calculated by logistic regression analyses. In the health status study, criteria for considering potential confounders included having been identified in other studies as confounders (Rothman and Greenland, 1998). Age and socio-economic status (education, occupation and living conditions) were examined as potential confounders because the knowledge of being profound predictors of health (Rothman and Greenland, 1998).

Prevalence odds ratios for the pregnancy outcomes were calculated with 95% confidence interval (CI) and p-values. According to international literature (Restrepo et al., 1990; Correa et al., 1996; Doyle et al., 1997), the following variables - age at interview, age at pregnancy, pregnancy order, year of pregnancy and socio-economic status (level of education, mother and father occupation, living conditions) - were identified as potential confounders. Multiple logistic regression was used to estimate POR adjusted for several potential confounders simultaneously.



Multiple pregnancies occurring in the same woman are not independent events. It is possible that a few women who have several miscarriages each, raise the miscarriage rate in any given group (Selevan et al., 1985). Furthermore, the number of subsequent pregnancies depends on pregnancy outcome; a woman may be more likely to choose to become pregnant again after a spontaneous abortion than after a live birth. This would tend to elevate spontaneous abortion rates if they were based on all pregnancies per woman (Lipscomb et al., 1991).

To account for this possible lack of independence among pregnancy outcomes in women who experienced more than one pregnancy, logistic regression models using the general estimating equations algorithm and conducting analyses restricted to first pregnancies are used (Correa et al., 1996; Arbuckle et al., 1999).

In our study, the statistical analysis treated each pregnancy as one unit. Multiple pregnancies of the same woman were treated as independent observations. However, statistical analysis were also carried out for each of the last three pregnancies separately to take into account the variability in the risk of spontaneous abortion between women.

History of previous spontaneous abortion was examined but was not included in the statistical model as these losses might have been caused in part by the exposure to oil pollutants and might be correlated with the index outcome under study and thus have resulted in biased risk estimates (Weinberg, 1993; Arbuckle et al., 1999)

In the analysis process, standard errors were adjusted for the clustered nature of the sampling using the Huber-White method (Stata Corporation, 1999).



## **6.6. OPERATIONAL ASPECTS**

The epidemiological study was conducted between November 1999 to April 1999. During the first two months, communities were visited and the study explained. Data collection was carried out from January to April 1999. During this period, two different places were used as study headquarters, Coca and Shushufindi. Each day the team came back from the communities to these places and the data entry was done.

One male research assistant was employed, not living in the study area. He attended a one-week training session, where practice interviews were carried out and guidelines for conducting the interview provided. Both, the epidemiologist and the assistant were aware of the exposed vs. unexposed status of the study subjects since it was impossible to avoid this knowledge. The work team received the support of the Sandi Yura and FUSA community health workers' (CHWs) associations for transport within the study area.

## **6.7. ETHICAL CONSIDERATIONS**

The study was planned together with the *FDA* Board and community leaders (section 4.1). The study was presented to the participants as a health status survey. Informed consent was obtained from all study participants. Confidentiality of all information collected was maintained and sick persons received free medical attention and treatment.

The results of the environmental conditions, the epidemiological study and a cancer cluster investigation with a detailed discussion of the findings and the methodological considerations of each one of the studies will be presented in the following chapter.



## CHAPTER SEVEN

### THE EPIDEMIOLOGICAL STUDY: RESULTS AND DISCUSSIONS

#### 7.1. ENVIRONMENTAL EXPOSURE ASSESSMENT

##### 7.1.1. Results

The results of the water analysis in the exposed contaminated communities are presented in Table 7-1. No Total Petroleum Hydrocarbon (TPH) contamination was found in rivers close to non-exposed communities.

In the exposed area, eighteen streams from 8 communities were contaminated with TPH ranging the hydrocarbon concentration from 0.02 parts per million (ppm) in the Manduro 1 stream to 2.883 ppm in the Basura river. In some streams hydrocarbons concentration reached 144 and 288 times the limit permitted by the European Community regulation<sup>14</sup> (Zehner and Villacreces, 1998). No contamination was found in two streams in the other exposed community.

Review of existing data collected independently by Zehner and Villacreces (1998) from 46 streams showed contamination in those located in areas of oil activities while in areas without

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<sup>14</sup> The United States criterion for domestic water supply is: "virtually free from oil and grease, particularly from the tastes and odours that emanate from petroleum products" (United States Environmental Protection Agency, 1986). The recommended maximum concentration of TPH in the European Union is 0.01 ppm. It has been demonstrated in toxicological studies that concentrations of 0.01 ppm of crude oil can cause sublethal effects in freshwater fish, and 0.1 ppm are known to be fatal to sensitive marine larvae (United States Environmental Protection Agency, 1986).



such activities no water contamination by TPH was found.

**Table 7-1. Concentration of Total Petroleum Hydrocarbon (TPH) <sup>a</sup> in the streams of communities surrounding oil fields; Ecuador 1999.**

IDENTIFICATION (stream)		TOTAL PETROLEUM HYDROCARBONS (ppm)	RATE OF CONTAMINATION
Community 1	Toachi	0	0
	Escuela 28-M	0	0
Community 2	Pozo 66	0.04	4
	Río Negro	1.438	143
Community 3	Victoria 1	0.051	5
	Victoria 2	1.426	142
Community 4	Itaya 1	0.043	4
	Itaya 2	0.028	2
Community 5	Escuela 18-N	0.036	3
	Jiménez	0.028	2
Community 6	Huamayacu	1.444	144
	Basura	2.883	288
	Iniap	0.097	9
	Huamayacu verde	0.529	52
Community 7	Lumu pueblo	0.066	6
	Lumu 3	0.055	5
Community 8	Dayuma	0.145	14
Community 9	Manduro 1	0.02	2
	Piscina Manduro	0.434	43
	Manduro 2	0.108	10

<sup>a</sup> The permitted limit for hydrocarbons in drinking water according to the European Community laws is 0.01 parts per million (ppm).

**7.1.2. Discussion**

The analysis of the water undertaken showed a severe exposure to oil chemicals by the residents of the exposed communities. These data confirm the residents of these communities are exposed to pollutant levels originated from the oil activity that exceeds significantly the internationally recognised safety limits (Zehner and Villacreces, 1998). Though the initial time of exposure is not known, numerous reports have indicated the exposure has occurred since the beginning of the oil exploration in the area in the 70s (Dirección General de Medio



Ambiente, 1989, Kimerling, 1991; Centro de Derechos Económicos y Sociales, 1994; Garzón, 1995; Fabra, 1998). Longitudinal data do not exist on the levels of exposure over time.

A study by the Ecuadorian government of 187 wells found that crude oil was regularly dumped into the woods and bodies of water. Another Ecuadorian government study found elevated levels of oil and grease in all of 36 samples taken from rivers and streams near productions sites, and also found that a shortage of dissolved oxygen in the majority of water samples had seriously harmed the aquatic ecosystem<sup>15</sup>.

In 1994, a study carried out by the *Centro de Derechos Económicos y Sociales* (1994) also found elevated levels of oil pollutants in the streams and rivers of the area which support a long term exposure of the residents to these toxics. Recently, a report from the Ministry of Environment (1999) supported these results when concentrations of TPH over 500 times the limit permitted were found in the streams of one of our studied communities.

In summary, the population living in the proximity of oil fields has been exposed to oil contaminants. Based on international standards the level of contamination poses a substantial potential risk to health. The environment assessment provides evidence that the streams closed to communities living in the proximity of oil fields are currently contaminated (see Photo 7-1; 7-2).

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<sup>15</sup> Information taken from: <http://www.Texacorainforest.org/claims/index.html>.



## 7.2. HEALTH STATUS



**Photo 7-1. Children playing beside an oil well. Their house is just few meters from the oil well (photo M. San Sebastian).**



**Photo 7-2. Indigenous woman collecting water for drinking and cooking after an oil spill (photo J. Kimerling).**



## **7.2. HEALTH STATUS**

### **7.2.1. Results**

#### **7.2.1.1. Characteristics of Participants**

Nine communities in the exposed area and fourteen in the comparison area were included in the study. The participation rates for the two areas were 70.2% for the exposed (428 women) and 79% for the non-exposed area (347 women). Sixty women (14%) from the exposed area and fifty-six (16.1%) from the unexposed were excluded because of living less than 4 years in the communities. Information from the questionnaire was therefore available for 368 and 291 of the subjects respectively.

Those exposed showed little differences in length of residence, age group, ethnic group, marital status and educational level from the controls (Table 7-2). However, women in exposed areas worked less in agriculture (72.6%) than the ones in non-exposed communities (86.3%). Females' husbands in exposed communities tend to work more in oil companies (7.8%) than in the control group (1.3%).

None of the women was classified as a cigarette smoker or alcohol consumer.

Living conditions were assessed through three indicators: type of house, possession of refrigerator and latrine. Living conditions, as measured by these variables, were better in exposed communities than control communities.

The exposed and non-exposed communities showed differences in sources of water for drinking, bathing and washing. Women from exposed communities were less likely to use water from the rivers.



**Table 7-2. Socio-demographic characteristics of the study population (x=mean; sd=standard deviation).**

Characteristic	Exposed group (%) n= 368		Comparison group (%) n= 291	
<b>Age of persons (years)</b>				
17-20	45	(12.2)	43	(14.8)
21-25	72	(19.6)	45	(15.5)
26-30	75	(20.4)	63	(21.6)
31-35	65	(17.7)	43	(14.8)
36-40	56	(15.2)	49	(16.8)
41-45	55	(14.9)	48	(16.5)
	x= 30.5 sd=7.8		x=30.8 sd=8.3	
<b>Time of residence (years)</b>				
4-10	116	(31.5)	112	(38.5)
11-20	191	(51.9)	147	(50.5)
> 21	61	(16.6)	32	(11)
	x=14.4 sd=6.1		x=13.5 sd=6.1	
<b>Ethnic group</b>				
Mestizo	360	(97.8)	283	(97.3)
Black	6	(1.6)	2	(0.7)
Indigenous	2	(0.5)	6	(2.1)
<b>Marital status</b>				
Single	38	(10.3)	30	(10.3)
Married	308	(83.7)	245	(84.2)
Widow	22	(6)	16	(5.5)
<b>Education</b>				
None	17	(4.6)	8	(2.7)
Primary non-finished	74	(20.1)	69	(23.7)
Primary	216	(58.7)	178	(61.2)
Secondary non-finished	41	(11.1)	28	(9.6)
Secondary	20	(5.4)	8	(2.7)
<b>Total persons at home</b>				
	x=6.3 sd=4.5		x=6.1 sd=2.4	
<b>Main occupation</b>				
Agriculture	267	(72.6)	251	(86.3)
Other	101	(27.4)	40	(13.8)
<b>Husband occupation</b>				
Agriculture	243	(66)	223	(76.6)
Oil company	29	(7.8)	4	(1.3)
Palm company	9	(2.4)	3	(1.0)
Other	27	(7.3)	16	(5.4)
<b>Living conditions</b>				
Cement house	49	(13.3)	20	(6.8)
Refrigerator	127	(34.5)	39	(13.4)
Latrine	186	(50.5)	111	(38.1)
<b>Water use</b>				
Drink from river	27	(7.3)	70	(24.0)
Bath in river	103	(28.0)	162	(55.6)
Wash in river	132	(35.9)	191	(65.6)



#### **7.2.1.2. Self-reported symptoms**

Table 7-3 compares prevalence of symptoms in the two weeks before the survey in the exposed and control groups. Significant difference between groups was found regarding skin mycosis (POR: 1.46; 95% CI: 1.08-1.97).

When exposed participants' perceptions of their own symptoms during the past 12 months were compared with those experienced by the comparison group, significant differences were found with respect to nose itching (POR: 1.94; 95% CI: 1.47-2.57), cough (POR: 1.45; 95% CI: 1.01-2.07), sore throat (POR: 1.62; 95% CI: 1.01-2.58) and gastritis (POR: 1.52; 95% CI: 1.04-2.21). Red eyes (POR: 1.23; 95% CI: 0.97-1.56), tiredness (POR: 1.43; 95% CI: 0.95-2.13) and skin mycosis (POR: 1.33; 95% CI: 0.99-1.78) were also more prevalent in the exposed communities. The results are provided in Table 7-4.

#### **7.2.1.3. Controlling for confounding factors**

Adjustment for the effects of potential confounders was made by logistic regression analysis. Table 7-3 and 7-4 show the results for the last 2 weeks and 12 past months respectively.

Prevalence odds ratio in the last 2 weeks for skin mycosis (POR: 1.37; 95% CI: 1.01-1.86) was statistically significant after adjustment. Other symptoms (POR: 1.33; 95% CI: 0.97-1.83) and tiredness (POR: 1.48; 95% CI: 0.94-2.30) were also more prevalent in the exposed communities.

In the last 12 months, there was an overall excess in most of the listed symptoms (20 of 23 symptoms) in the exposed group. Itchy nose (POR: 2.18; 95% CI: 1.64-2.91) and sore throat (POR: 1.68; 95% CI: 1.02-2.75) were statistically significant in the exposed group. Headache



**Table 7-3. Prevalence of self-reported symptoms in the last 2 weeks by women of exposed and non-exposed communities with the corresponding unadjusted prevalence odds-ratio (POR), confidence intervals (95% CI) and adjusted prevalence odds ratios, confidence interval (95% CI) and p-values<sup>a</sup>**

SYMPTOMS	EXPOSED		UNEXPOSED		POR	95% CI	POR <sup>b</sup> adjusted	95% CI	p- value
	Communities		Communities						
	n	%	n	%					
General									
Fever	94	(25.5)	58	(19.9)	1.37	0.87-2.16	1.32	0.82-2.13	> 0.20
Headache	279	(75.8)	226	(77.7)	0.90	0.64-1.26	1.01	0.70-1.45	> 0.20
Red eyes	179	(48.6)	131	(45.0)	1.15	0.90-1.47	1.12	0.80-1.55	> 0.20
Ear pain	113	(30.7)	104	(35.7)	0.79	0.51-1.22	0.85	0.57-1.27	> 0.20
Tiredness	260	(70.7)	191	(65.6)	1.26	0.85-1.86	1.48	0.94-2.30	0.08
Frequent urination	201	(54.6)	138	(47.4)	1.33	0.84-2.10	1.20	0.74-1.94	> 0.20
Dizziness	229	(62.2)	168	(57.7)	1.20	0.76-1.90	1.41	0.89-2.23	0.14
Respiratory									
Itchy nose	141	(38.3)	105	(36.1)	1.10	0.81-1.49	1.14	0.84-1.55	> 0.20
Cough	214	(58.2)	157	(54.0)	1.18	0.89-1.57	1.15	0.80-1.65	> 0.20
Bronchitis	11	(3.0)	11	(3.8)	0.78	0.36-1.69	0.73	0.27-1.93	> 0.20
Digestive									
Sore throat	194	(52.7)	132	(45.4)	1.34	0.88-2.03	1.47	0.89-2.43	0.12
Nausea / Vomiting	116	(31.5)	83	(28.5)	1.15	0.81-1.63	1.10	0.73-1.66	> 0.20
Diarrhoea	55	(14.9)	54	(18.6)	0.77	0.50-1.18	0.88	0.59-1.33	> 0.20
Gastritis	266	(72.3)	192	(66.0)	1.34	0.89-2.02	1.27	0.79-2.04	> 0.20
Stomach pain	235	(63.9)	174	(59.8)	1.18	0.82-1.72	1.21	0.80-1.83	> 0.20
Skin									
Red skin	72	(19.6)	63	(21.6)	0.88	0.52-1.47	1.02	0.57-1.81	> 0.20
Pyodermitis	81	(22.0)	63	(21.6)	1.02	0.61-1.69	1.07	0.61-1.86	> 0.20
Skin mycosis	143	(38.9)	88	(30.2)	1.46	1.08-1.97	1.37	1.01-1.86	0.03
Musculoeskel.									
Body pain	239	(64.9)	190	(65.3)	0.98	0.66-1.45	1.13	0.73-1.74	> 0.20
Joint pain	204	(55.4)	178	(61.2)	0.79	0.50-1.22	0.82	0.49-1.39	> 0.20
Cramps	94	(25.5)	90	(30.9)	0.76	0.49-1.18	0.87	0.54-1.39	> 0.20
Nervous									
Sleeping problems	138	(37.5)	98	(33.7)	1.18	0.80-1.74	1.32	0.83-2.13	> 0.20
Other									
Other sympt.	97	(26.4)	63	(21.6)	1.29	0.94-1.77	1.33	0.97-1.83	0.07

<sup>a</sup> Standard errors adjusted for clustering.  
<sup>b</sup> POR adjusted for age, female and her husband’s occupation and living conditions.



**Table 7-4. Prevalence of self-reported symptoms in the last 12 months by women of exposed and non-exposed communities with the corresponding unadjusted prevalence odds-ratio (POR), confidence intervals (95% CI) and adjusted prevalence odds ratios, confidence interval (95% CI) and p-values<sup>a</sup>.**

SYMPTOMS	EXPOSED		UNEXPOSED		POR	95% CI	POR <sup>b</sup> adjusted	95% CI	p- value
	Communities		Communities						
	n	%	n	%					
General									
Fever	226	(61.4)	172	(59.1)	1.10	0.75-1.61	1.16	0.76-1.75	> 0.20
Headache	319	(86.7)	242	(83.2)	1.31	0.83-2.08	1.56	0.90-2.71	0.10
Red eyes	181	(49.2)	128	(44)	1.23	0.97-1.56	1.28	0.97-1.69	0.08
Ear pain	141	(38.3)	104	(35.7)	1.11	0.80-1.54	1.32	0.95-1.84	0.09
Tiredness	265	(72.0)	187	(64.3)	1.43	0.95-2.13	1.41	0.85-2.35	0.17
Frequent urination	234	(63.6)	173	(59.5)	1.19	0.79-1.78	1.16	0.71-1.88	> 0.20
Dizziness	235	(63.9)	176	(60.5)	1.15	0.81-1.63	1.35	0.86-2.12	0.18
Respiratory									
Itchy nose	170	(46.2)	89	(30.6)	1.94	1.47-2.57	2.18	1.64-2.91	< 0.01
Cough	276	(75.0)	196	(67.4)	1.45	1.01-2.07	1.35	0.86-2.12	0.18
Bronchitis	20	(5.4)	13	(4.5)	1.22	0.55-2.72	1.40	0.56-3.46	> 0.20
Digestive									
Sore throat	240	(65.2)	156	(53.6)	1.62	1.01-2.58	1.68	1.02-2.75	0.03
Nausea / Vomiting	150	(40.8)	109	(37.5)	1.14	0.86-1.52	1.25	0.92-1.70	0.14
Diarrhoea	143	(38.9)	96	(33)	1.29	0.84-1.96	1.54	0.94-2.51	0.08
Gastritis	263	(71.5)	181	(62.2)	1.52	1.04-2.21	1.43	0.92-2.22	0.10
Stomach pain	252	(68.5)	181	(62.2)	1.32	0.87-1.99	1.21	0.72-2.04	> 0.20
Skin									
Red skin	95	(25.8)	65	(22.3)	1.21	0.73-1.99	1.31	0.76-2.25	> 0.20
Pyodermitis	100	(27.2)	79	(27.1)	1.0	0.60-1.65	0.94	0.53-1.68	> 0.20
Skin mycosis	147	(39.9)	97	(33.3)	1.33	0.99-1.78	1.15	0.83-1.59	> 0.20
Musculoesk.									
Body pain	244	(66.3)	179	(61.5)	1.23	0.83-1.81	1.26	0.77-2.06	> 0.20
Joint pain	170	(46.2)	128	(44)	1.09	0.78-1.52	1.09	0.74-1.61	> 0.20
Cramps	127	(34.5)	101	(34.7)	0.99	0.69-1.40	1.10	0.76-1.59	> 0.20
Nervous									
Sleeping problems	146	(39.7)	100	(34.4)	1.25	0.84-1.87	1.39	0.88-2.20	0.15
Other									
Other sympt.	59	(16.0)	50	(17.2)	0.92	0.57-1.46	0.98	0.58-1.67	> 0.20

<sup>a</sup> Standard errors adjusted for clustering.

<sup>b</sup> POR adjusted for age, female and her husband's occupation and living conditions.



(POR: 1.56; 95% CI: 0.90-2.71), red eyes (POR: 1.28; 95% CI: 0.97-1.69), ear pain (POR: 1.32; 95% CI: 0.95-1.84), diarrhoea (POR: 1.54; 95% CI: 0.94-2.51) and gastritis (POR: 1.43; 95% CI: 0.92-2.22) were also more prevalent in the exposed communities.

### 7.2.1.4. Use of medical services

The prevalence of subjectively reported physical impairment and use of health care facilities is presented in Table 7-5. No significant differences after adjustment for the potential confounders were found between groups according to the indicators used.

**Table 7-5. Prevalence of self-reported physical impairment and use of health care facilities among females of exposed and non-exposed communities with the corresponding unadjusted prevalence odds-ratio (POR), confidence intervals (95% CI) and adjusted prevalence odds ratios, confidence interval (95% CI) and p-values<sup>a</sup>.**

VARIABLE	Exposed Commun.	Unexposed Commun.	POR	95% CI	POR <sup>b</sup> adjusted	95% CI	p- value
Bedridden in the past 2 weeks	38 (10.3)	24 (8.2)	1.28	0.70-2.31	1.48	0.80-2.71	> 0.20
Encounter with a doctor/CHW in past 2 weeks	31 (8.4)	20 (10.0)	0.83	0.48-1.42	0.68	0.37-1.23	> 0.20
Encounter with a traditional healer in past 2 weeks	10 (2.7)	15 (5.2)	0.51	0.18-1.39	0.68	0.17-2.63	> 0.20
Medication used on physician's / CHW/ pharmacy advice in past 2 weeks	66 (17.9)	59 (20.3)	0.85	0.56-1.29	0.76	0.47-1.22	> 0.20
Overnight admission to a hospital in past 12 months	35 (9.5)	23 (7.9)	1.22	0.57-2.58	0.87	0.33-2.26	> 0.20
Any death at home in past 12 months	13	11	1.00	0.43-2.32	0.91	0.34-2.48	> 0.20

<sup>a</sup>Standard errors adjusted for clustering.  
<sup>b</sup>POR adjusted for age, female and her husband’s occupation and living conditions.



### 7.2.2. Discussion

The principal health effects found in previous studies on acute exposure to crude oil have been headache, throat irritation, itchy eyes and tiredness (Campbell et al., 1993; Lyons et al., 1999). In one of the studies, the exposed population also reported significantly more anxiety and depression (Lyons et al., 1999). A follow up study of one of these studies reported significantly higher scores on the general health questionnaire (OR=2.92; 95% CI=2.33-3.5) and tiredness in the exposed group (OR: 1.86; 95% CI: 1.19-2.92) (Campbell et al., 1994). A recent study conducted on residents involved in cleanup activities after an oil spill in Japan reported an increase on back and leg pain, headache and symptoms of eyes and throat (Morita et al., 1999).

In our study, the increase in the reported prevalence of symptoms might be explained by the environmental exposure to crude oil and its components by ingestion, inhalation or dermal contact. Accidental contact with petroleum or exposure to its vapour causes skin irritation and stinging or redness of the eyes. Prolonged or repeated exposure to low concentrations of volatile components of oil can produce nausea, dizziness, headache or drowsiness (Goldstein and Bendit, 1970; Kaplan et al., 1993). Importantly, our findings are similar to those found in residents exposed to accidental oil spills (Campbell et al., 1993, 1994; Lyons et al., 1999; Morita et al., 1999).

Since the self-reported symptoms in our study are similar to those found in other oil pollutants related studies, one might have expected higher risks in the exposed population. However, the small differences found in the symptoms prevalence between populations might be explained by two reasons: first, both populations have reported a elevated prevalence of symptoms which might be due to the poor access to health services and the hard living conditions of the



rainforest (Kroeger, 1982). In this situation, finding big differences in risk between groups is difficult. And second, low socio-economic conditions have been related to poor health status (Kunst, 1997; Department of Health, 1998; Baum, 1998; Berkman and Kawachi, 2000). In our study, the residents of exposed communities might have economically benefited by the existence of the oil industry (as shown by the socio-economic indicators used) which could have helped to decrease the risk of disease in the exposed group.

This study brought out as well the adverse health conditions that prevail in rural Ecuador: high prevalence of diseases and the low utilisation of health care facilities. Regarding morbidity, the elevated prevalence of symptoms reported is similar to other health surveys in rural areas. Studies in Bolivia have reported 42% of participants experiencing a health problem over a two-week period (Frerichs et al., 1980) and a 41.5% has been reported in Ecuador among indigenous population of the Amazon basin (Kroeger, 1982).

The use of health care facilities was comparable in both groups. This finding suggests similar accessibility of the females to the medical services, which argues against the possibility that the health differences found might be explained by different access to health services.

#### **7.2.2.1. Methodological considerations**

Several limitations affect the results of the study. Non response bias is a possible source of error. However, the similarity of the socio-demographic variables among the study areas indicates that non exposed communities were an adequate reference population. Responses rates were high and similar in the exposed and control areas (70.25% vs. 79%) avoiding to some extent the non-response bias. The high participation might indicate that the results are generalizable to the target population at large. The good response can be attributed to the



involvement of community leaders and the researcher after several years of participation in a primary health programme in the area. Reasons for non-participation were unknown.

The study was community based and communities were randomly chosen. People not living long enough in the area, where the cases have been thought to have been exposed, were excluded. One source of potential selection bias is that only current residents of the target or comparison areas are eligible and migration might have been considerable. The potential impact of this bias in the study results could not be determined.

Recall bias was one potential problem in the study, as the self-reporting of diseases might not be precise. In addition, the lack of medical records and the difficulty of verification of some complaints such as headaches, fatigue, fever, etc. might affect the results. Interviewer bias should also be taken into account since epidemiologist was not blind to the exposure. However, the small differences in prevalences found between exposed and non-exposed participants suggest these biases were not occurring.

One important threat to the validity of the findings in this type of studies comes from the reporting bias since people who believe they are exposed might report higher levels of symptoms. To address this bias, other studies have adjusted for an increased anxiety or the belief that exposure has affected their health (Ozonoff et al., 1987; Lyons et al., 1999). It was not possible to follow this advice in our study due to the long-term exposure to oil pollution of the communities and the belief in exposed communities that oil is affecting their health (see section 1.3). We tried to solve these limitations presenting the study to the communities as a health study within a primary health care programme. In addition, the symptoms observed to be more strongly associated with exposure are suggestive of a causal mechanism



between exposure and symptoms, which in opposition to a “pan symptom effect”, indicate that reporting bias is not operating.

Another limiting factor of environmental studies investigating health effects is the potential misclassification of exposed and unexposed populations. In the design of the study, some of these limitations were taken under consideration. Communities within a 5 km. of an oil field were considered exposed. Non-exposed communities were selected among those that were at a minimum of 30 km. upstream from oil fields. Accepted persons in exposed or comparison communities had lived in the same community for at least three years.

Assessment of individual exposure from a chemical release in a community is complicated by the presence of background levels of ambient exposure, the variety of chemicals and the methods for dose assessment. Multiple exposures not only pose the problem of identifying the toxic chemical responsible, but also the problem of interaction between chemicals in the expression of toxic effects.

In our study, no data on how people had been exposed in the past to the chemicals existed. There is little or no information on chronic toxicity from the diversity of chemical substances spilled from the oil fields. Even the inventory of the chemical substances spilled by oil companies in Ecuador is unknown (Kimerling, 1991). The same exposure status was assigned to every individual within the same study area, even though the individuals certainly did not have the same level of exposure to oil pollutants.

Confounders were balanced in the sample with respect to socio-economic and geographic conditions. Each comparison was adjusted for other potential confounders (age, level of



education, females and their husbands' occupation and living conditions) using a logistic regression analysis. However, the possibility that some residual confounding remains due to misclassification of some factor in the analysis cannot be ruled out completely. No smoking information could be found.

Since the study tested for many variables, it is possible that some of them gave significant results by chance due to multiple comparisons. In this case, multiple inference procedures might be suggested. However, the decision to adjust formally for multiple testing is debated among statisticians<sup>15</sup> (Rothman and Greenland, 1998).

In summary, women living in exposed communities reported higher rates of physical symptoms than women in control areas. Symptoms significantly associated with exposure after adjustment were those expected from known toxicological effects of oil. It is unlikely that the excess found in the exposed group is due to confounding, bias or chance.

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<sup>15</sup> It has been argued that the interpretation of p-values when multiple comparison are made should be prudent. However, the management of this problem should be cautious as well. A proposed strategy, inflating the calculated p-values by some factor dependent on the number of comparisons, could cause a reduction of false positives but at the expense of an increase frequency of false negatives. The main question is that no solution based exclusively on the calculation and interpretation of p-values could ever be satisfactory, as it is not appropriate either to interpret the results of any single study, even evaluating only one association, on the sole base of the p-value. In relation to this, it has been suggested to report each association making clear the context of multiple comparisons from which it arrives. Other factors related to the results of a particular study, such as dose-response, biological plausibility or consistency with previous research, are much more valuable elements when interpreting these results (Lang and Secic, 1997; Rothman and Greenland, 1998).



**7.3. REPRODUCTIVE HEALTH**

**7.3.1. Results**

**7.3.1.1. Characteristics of the participants**

The characteristics of this population have been presented in section 7.2.1.1. In this study, three women in the exposed group and eight in the non-exposed were excluded because the forms were incomplete or unreadable. Information from the questionnaire was available for 365 (59.8%) and 283 (64.4%) of the participants respectively.

**7.3.1.2. Characteristics of the pregnancies**

Overall 555 (85.6%) women reported having at least one pregnancy, without significant differences in both groups. Of the women reporting at least one pregnancy, 508 (91.5%) had had a live-born child and 111 (20.0%) a fetal loss (spontaneous abortion or stillbirth). The differences between exposed and non-exposed groups are presented in Table 7-6.

**Table 7-6. Characteristics of the pregnancies by exposure status.**

	EXPOSED		UNEXPOSED		TOTAL	
	n	(%)	n	(%)	n	(%)
Responders	365	(100)	283	(100)	648	(100)
At least one pregnancy	310	(84.9)	245	(86.5)	555	(85.6)
At least one live born child	279	(90.0)	229	(93.4)	508	(91.5)
At least one fetal death	77	(24.8)	34	(13.8)	111	(20.0)
Ever consulted doctor about infertility	0		0		0	

**7.3.1.3. Pregnancy outcome by exposure**

Table 7-7 shows details of the individual pregnancies according to the exposure. The total number of pregnancies reported was 1377. Of these pregnancies, 7.5% were spontaneous abortions and 1.8% ended as stillbirths.



**Table 7-7. Outcome of pregnancies by exposure status.**

	EXPOSED		UNEXPOSED		TOTAL	
	n	(%)	n	(%)	n	(%)
Total reported pregnancies	791	(100)	586	(100)	1377	(100)
Pregnancy with one or more live births	700	(88.4)	548	(93.5)	1248	(90.6)
Spontaneous abortion (< 28 weeks)	78	(9.8)	26	(4.4)	104	(7.5)
Stillbirth (>= 28 weeks)	13	(1.6)	12	(2.0)	25	(1.8)

Pregnancies of women living in contaminated communities were more likely to end in a spontaneous abortion than those of women living in comparison communities (POR: 2.34; 95% CI: 1.48-3.71;  $p<0.01$ ). No association was found between stillbirth and exposed women (POR: 0.85; 95% CI: 0.35-2.05;  $p=0.83$ ).

**7.3.1.4. Controlling for confounding factors**

Logistic regression analysis was used to examine the combined effects of the potential confounding factors and exposure on the association of spontaneous abortion. After adjustment for the potential confounders, the estimated odds ratio was slightly higher than the crude value and that the association between spontaneous abortion and living in the proximity of oil fields remained highly significant (POR: 2.47; 95% CI: 1.61-3.79;  $p<0.01$ ) (Table 7-8).

Further analysis was carried out to take into account the variability in the risk of spontaneous abortion between women, stratifying by pregnancy number (numbering from the last). A higher risk of spontaneous abortion in exposed women was found in the three different strata, the risks in first two pregnancies were statistically significant (Table 7-8).

No evidence of interaction was found between the exposure and the investigated potential confounders with respect to their effect on spontaneous abortion.



**Table 7-8. Risk of spontaneous abortion by exposure status<sup>a</sup>.**

	Exposed n (%)	Non-exp. n (%)	POR	(95% C.I.)	Adjusted POR <sup>b</sup>	(95% C.I.)
<b>Last three reported pregnancies</b>	<b>78 (9.8)</b>	<b>26 (4.4)</b>	<b>2.34</b>	<b>(1.48-3.71)</b>	<b>2.47</b>	<b>(1.61-3.79)</b>
Last pregnancy	24 (7.9)	12 (4.9)	1.64	(0.80-3.36)	1.62	(0.70-3.75)
Previous one pregnancy	24 (8.9)	7 (3.5)	2.65	(1.11-6.32)	2.76	(1.03-7.39)
Previous two pregnancy	30 (14.4)	7 (5.0)	3.15	(1.33-7.48)	3.66	(0.97-13.73)

<sup>a</sup> Standard errors adjusted for clustering.  
<sup>b</sup> Adjusted for age at interview, age at pregnancy, pregnancy order, year of pregnancy, educational level, female and her husband occupation and living conditions.

**7.3.2. Discussion**

These findings are consistent with other reports from the area suggesting an increased risk of spontaneous abortions in women living in communities surrounded by oil fields (Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana, 1993; Centro de Derechos Económicos y Sociales, 1994).

To our knowledge, corresponding studies of residents near oil fields are lacking. Studies in industrialized countries tend to be based on lower exposures than those in Ecuador. In Sweden, a study concluded that the exposure levels near a petrochemical industry were not associated with an increased risk of unfavorable pregnancy outcome (Axelsson and Molin, 1988). However, in Bulgaria an association between exposure to emissions from petrochemical industries and outcome of pregnancy showed a higher prevalence of spontaneous abortions among residents near the industries (Tabacova and Vucow, 1991). An increased risk of spontaneous abortion for women workers with frequent exposure to petrochemicals compared with those working in non-chemical plants was also found in China



(Xu et al., 1998). In addition, studies on animals support the evidence of high risk of adverse reproductive outcomes when exposed to oil pollutants (Scheiner, 1984; Walters et al., 1987; Feuston et al., 1997).

No association was found in our study between stillbirth and women living in the proximity of oil fields. Due to its low frequency, stillbirth has been considered a weak indicator of developmental toxicity in relation to environmental chemicals (World Health Organisation, 1984).

#### **7.3.2.1. Methodological considerations**

Limitations of study design, and methods of data collection, due to logistic and economic shortcomings, create some potential for biases in this study. Selection, non-response, recall and interviewer bias as well as misclassification of exposure have been discussed in section 7.2.2.1.

One important threat to the validity of the findings in this type of study comes from reporting (recall) bias since recall is likely to be incomplete, and people who believe they are exposed might be more likely to recall spontaneous abortions (Wilcox and Horney, 1984). We tried to limit this problem by presenting the study to the communities as a general health study within a primary health care programme. However, the overall proportions of pregnancies reported as ending in spontaneous abortion in the unexposed communities were lower than in other similar surveys in developing countries. Percentage of self-reported pregnancies terminating in miscarriage varied between 6.3 in Peru to 9.1 in Colombia and Venezuela (Hobcroft, 1987). It has also been reported that when the event is ascertained retrospectively by means of a questionnaire, the rates of spontaneous abortion are between 5-10% (Hemminki et al.,



1980). In this study, the rates in the unexposed population were 4.4 %, suggesting a true low risk or underreporting.

Recall might also be expected to increase with proximity of the pregnancy to the date the questionnaire was administered. The presence of the association with exposure after stratifying by pregnancy order, numbering from the last, suggests that it is not likely due to this bias.

The study design did not allow us to address certain other questions. First, the validity of the reported spontaneous abortion was not possible to address due to the lack of medical records. Several studies from industrialised countries have reported that such a problem does not necessarily cause a serious distortion (Hewson and Bennett, 1987). In a study among laboratory workers in Sweden, accuracy for miscarriages was high (Axelsson and Rylander, 1989). Ninety-four percent of self-reported spontaneous abortion could be confirmed by reviewing medical records in a study conducted among workers at two semiconductor manufacturing plants in the United States (Correa et al., 1996). Self-report of fetal loss was also reliable in a study conducted on dry cleaning workers in England (Doyle et al., 1997). Second, we did not assess whether early (subclinical) fetal loss might be affected by oil pollutants. There is a high probability for women not to recognize the event as such but to perceive it as a delayed menstrual period if it occurs very early in pregnancy (Wilcox et al., 1988).

None of the potential confounders examined - age at interview, age at pregnancy, pregnancy order, year of pregnancy, socioeconomic status - could explain the association between



spontaneous abortion and living in the proximity of oil fields. However, some residual confounding may remain due to misclassification of some factor in the analysis.

Repeated spontaneous abortions in the same women were treated as independent events in our analyses, which can lead to spuriously narrow confidence intervals. However, the allowance for clustering by community allows implicitly for this source of additional variation, so confidence intervals should not be misleading. The persistence of the association of spontaneous abortions with exposure after stratifying by pregnancy number (from the last), statistically significant in two out of three strata, gives further reassurance on this point.

This study has shown the importance of oil pollutants in the epidemiology of reproductive health. The results provide some evidence of an increased risk of spontaneous abortions on women living in the proximity of oil fields, after adjustment for well-known risks common in developing country settings.

#### **7.4. INCIDENCE OF CANCER IN SAN CARLOS**

In response to a community concern about the health effects of oil pollution, San Carlos village was visited by the researcher in October of 1998. In part of a broader study of the situation, the researcher found, that the village health worker mentioned the presence of several cases of cancer. These cases were attributed by local people to their continued exposure to oil pollution.

This section reports the results of a preliminary analysis of environmental contamination of water sources, and cancer incidence and mortality in the village of San Carlos.



#### 7.4.1. Population and methods

##### 7.4.1.1. Area of study

San Carlos is a small village inhabited by peasants in the province of Orellana, north-eastern of Ecuador. The population numbers approximately 1,000, most of them arriving in the area in the 70s to farm, continuing the paths opened by the oil companies. They subsist mainly by agriculture and cattle-raising (Figure 7-1).

Physical infrastructure of San Carlos is poor. There is electricity but no piped drinking water or sewer services. The roads are deliberately paved by crude oil. There is a primary health centre in the village run by a doctor and a nurse. The nearest reference centre for an histopathological examination is in Quito, 300 km away (12 hours by bus).

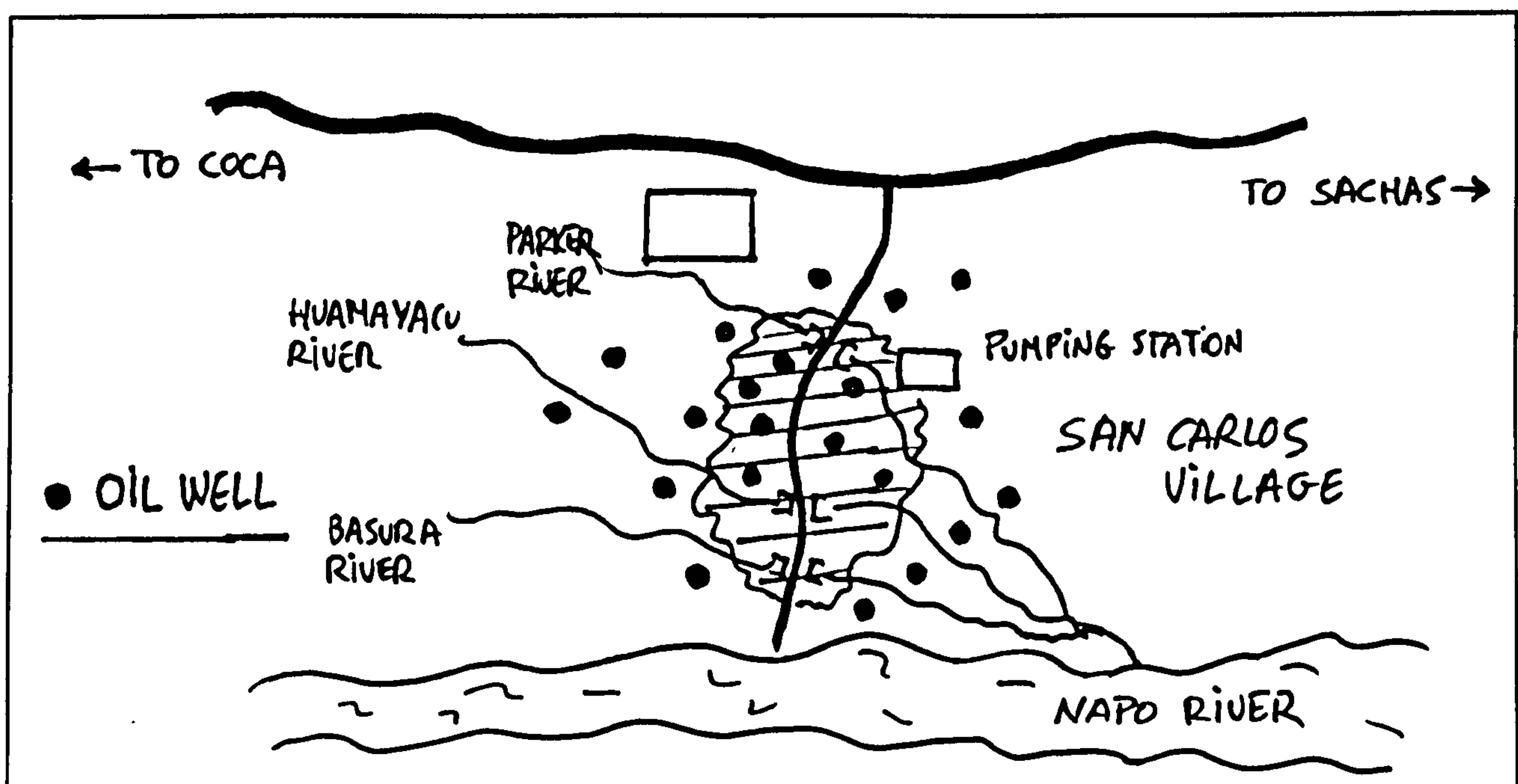


Figure 7-1. Map of San Carlos village and location of oil wells and rivers.

In the entrance to the village there is a large pumping station. More than 30 oil wells surround the village. Petroecuador, the national oil company, is responsible for managing this oil field. No permanent jobs have been created for the residents in the company. The station and the wells dispose of waste without treatment to the small rivers that cross the village (Talbot,



1999). These rivers are the only sources of water, and are used by the population for domestic use (to drink and cook), to bath and wash clothes. In the pumping station, there are four powerful gas burners burning gas day and night. The oil wells located in San Carlos have been in operation for more than 20 years (Garzón, 1995). There are no chemical or other industries in the area or its surroundings.

#### **7.4.1.2. Exposure assessment**

The main stream that crosses San Carlos is the Huamayacu river. In the surrounding areas of San Carlos are also the Basura and Parker rivers, and other small rivers used by the population of this village. During the month of March of 1999 samples of the Huamayacu, Basura, Parker and Iniap rivers were taken to measure total petroleum hydrocarbons. The methods used have been described in section 6.4.1.

#### **7.4.1.3. Data collection**

A preliminary list with potential cancer cases from 1989 to 1998 was prepared by the health workers at the village of San Carlos. The list included the name, age, time of residence and place of diagnosis. To confirm the diagnosis, data from the hospitals where people had been treated was solicited. Cases were included only when pathological evidence was present. No cancer registry is available in the Amazon region.

The cancers were grouped following the 9<sup>th</sup> International Classification of Diseases (ICD).

Population data of San Carlos, stratified by age and sex, were taken from census county statistics for 1998. These used the 1991 National Census extrapolated to 1998 (Instituto Nacional de Estadísticas y Censos, 1995).



#### **7.4.1.4. Statistical methods**

Statistical analysis was based on the comparison of observed (O) and expected (E) numbers of cancer cases; the expected numbers of deaths and cancer registrations were calculated from Quito reference population incidence rates, stratified by 5-year age group and sex. Quito, the capital city, is the only place in the country with an adequate cancer registry or publishing deaths by specific cause (Parkin, 1997; Sociedad de Lucha contra el Cáncer, 1998).

Observed and expected values, observed/expected (O/E) ratios, and their 95 percent confidence intervals based on the Poisson distribution exact method are reported.

#### **7.4.2. Results**

##### **7.4.2.1. Exposure assessment**

The results of the analysis of the samples taken from the rivers are presented in Table 7.1. In the Iniap stream, the hydrocarbon concentration was 0.09 parts per million (ppm), 0.5 in the Parker river, 1.44 in the Huamayacu and 2.88 ppm in the Basura river. This compares with a permitted limit for hydrocarbons in drinking water according to the European Community laws of 0.01 parts per million (ppm) (Zehner and Villacreces, 1998).

##### **7.4.2.2. Cancer incidence**

The population of San Carlos was estimated at 1000 (555 men and 455 women) in 1998. Eighteen cases were identified in the preliminary list. Out of them, ten were confirmed with pathological evidence during the period 1989-1998 as cancer cases. Three were diagnosed as benign tumours and for five cases there was no access to medical records.

The characteristics of the patients and the types of cancer are presented in Table 7-9. Most of the cancers diagnosed were in men (8/10), three were stomach cancer. Six were diagnosed in



the last 3 years. The age of diagnoses varied from 5 to 86 years. Of the 10 patients, 6 (all men) had already died; most of these deaths took place short time after the diagnoses. The residence time of the patients in San Carlos was from 7 to 30 years, with a mean of 17 years. Only one patient had worked in the oil industry, as a guardian of an oil field. From medical histories one patient could be identified as a smoker.

**Table 7-9. Cases of cancer found in the village of San Carlos, Orellana, 1989-1998.**

ICD9 <sup>a</sup>	SEX	TYPE OF CANCER	DATE of diagnoses	AGE of diagnoses	DATE of death	TIME of residence in San Carlos
156	M	Ampulla of Vater <sup>b</sup>	March 89	68	Jul. 89	22
151	M	Stomach	June 91	64	92	20
151	M	Stomach	August 92	55	Sept. 92	15
151	M	Stomach	June 97	65	Oct. 98	16
161	M	Larynx	Sept. 97	46	-	
155	M	Liver	August 98	86	Sept. 98	26
172	M	Melanoma	Nov. 96	52	August 97	15
204	M	Leukaemia <sup>c</sup>	July 93	5	-	7
202	F	Lymphom <sup>d</sup>	96	28	April 99	16
180	F	Cervix cancer	May 98	52	-	30

<sup>a</sup> ICD: 9<sup>th</sup> International Classification of Diseases.

<sup>b</sup> Ampulla of Vater: Others and non-specific from the biliary tract.

<sup>c</sup> Acute Lymphoblastic Leukaemia.

<sup>d</sup> Non Hodgkin's Lymphom.

A comparison with expected numbers, adjusted for age, is presented in Table 7-10. An overall excess for all types of cancer was found in the male population (8 observed vs. 3.5 expected) with a risk 2.26 times higher than expected (95% confidence interval (95% CI): 0.97-4.46). No overall excess for all types of cancer was found in females (2 vs. 4 expected; O/E ratio: 0.5; 95% CI: 0.06-1.80).



7.4.2.3. Cancer mortality

Table 7-11 shows the results of the mortality analysis for the 10 years. There was an overall excess of deaths for all types of cancer (6 vs. 1.6 expected) among the male population 3.6 times higher than the reference population (95% CI: 1.31-7.81). The excess was apparent for all sites represented, stomach and melanoma cancers being nominally statistically significant ( $p<0.05$ ). No deaths due to cancer were found in women (0 vs. 1.39 expected; 95% CI: 0-2.64).

Table 7-10. Cancer incidence in the village of San Carlos, 1999 (O= observed number of cancers; E= expected number of cancers; SIR= standardised incidence ratio (O/E); 95% CI= 95% confidence interval).

CANCER	MALES					FEMALES			
	ICD9	O	E	SIR	IC 95%	O	E	SIR	IC 95%
ALL cancers <sup>a</sup>	140-208	8	3.53	2.26	0.97-4.46	2	4	0.5	0.06-1.80
Stomach	151	3	0.64	4.68	0.95-13.68	0	0.36	0	-
Liver	155	1	0.06	16.66	0.41-92.83	0	0.05	0	-
Ampulla of Vater <sup>b</sup>	156	1	0.05	20.0	0.50-111.40	0	0.05	0	-
Larynx	161	1	0.03	33.33	0.83-185.66	0	0.004	0	-
Melanoma	172	1	0.06	16.66	0.41-92.83	0	0.06	0	-
Leukaemia <sup>c</sup>	204	1	0.37	2.70	0.06-15.05	0	0.26	0	-
Lymphom <sup>d</sup>	202	0	0.26	0	-	1	0.14	7.14	0.17-39.78
Cervix cancer	180	0	-	0	-	1	0.43	2.32	0.05-12.95
Others		0	2.06	0	-	0	2.65	0	-

<sup>a</sup> All cancers excluding non-melanoma skin cancer.  
<sup>b</sup> Ampulla of Vater: Others and non-specific from the biliary tract.  
<sup>c</sup> Acute Lymphoblastic Leukaemia.  
<sup>d</sup> Non Hodgkin's Lymphom.



**Table 7-11. Mortality from cancer in males in the village of San Carlos, 1999 (O= observed number of cancer deaths; E= expected number of cancer deaths; SMR= standardised mortality ratio of cancer (O/E) ; 95% CI = 95% confidence interval).**

CANCER	MALES				
	ICD9	O	E	SMR	95% CI
ALL cancers <sup>a</sup>	140-208	6	1.67	3.59	1.31-7.81
Stomach	151	3	0.36	8.33	1.69-24.33
Liver	155	1	0.046	21.73	0.54-121.08
Melanoma	172	1	0.014	71.42	1.78-397.85
Ampulla of Vater <sup>b</sup>	156	1	0.037	27.02	0.67-150.54
Others		0	1.23	0	-

<sup>a</sup> All cancers excluding non-melanoma skin cancer.  
<sup>b</sup> Ampulla of Vater: Others and non-specific from the biliary tract.

### 7.4.3. Discussion

This report presents an analysis of environmental contamination and incidence and mortality of cancer (1989-1998) in a village located in an oil producing area of the Amazon basin of Ecuador.

The analysis of water used for drinking, washing and bathing showed a severe exposure to TPH by the residents of San Carlos with samples ranging from 10 to 288 times higher than the limit permitted by the European Community regulation. These data confirm the residents of this village are exposed to pollutant levels originated from the oil activity that exceed significantly the European recognised safety limits.

The study suggests further an excess of cancers among the male population in the village of San Carlos. All specific cancer sites showed an excess. Results of overall cancer mortality were also 3.6 higher than expected among males.



Despite the excess of cancer found in San Carlos and the high exposure to oil pollutants, the attribution of causality to this association must be considered with caution. When interpreting the results, several issues should be taken into the account.

When a cluster is identified after an increased rate of a disease in an area, statistical results should be interpreted very cautiously. This process has been described as the “Texas sharp-shooter’s” procedure (Rothman, 1990). However, this study was led by local concern about overall health effects of oil pollution on their communities. This concern preceded identification of a cancer “cluster”. Therefore, the presented data are not wholly subject to the application of “Texas sharp-shooter” caution, strengthening the likelihood for a real effect. However, the high risk of cancer found in the population was based on small numbers, which is reflected in the wide confidence intervals, making it difficult to reject the possibility of chance.

Several limitations in the data and methods need also to be considered. Population data relied on county census estimated from 1991 National Census. Errors in population estimates, including differential migration patterns, might bias estimates of risk. However, to avoid this bias, population of San Carlos was overestimated and migration is considered to be low (president of the village, personal communication).

The completeness of the cancer registration in Quito is high, 95% (Sociedad de Lucha contra el Cáncer, 1998), but there may have been cancer cases in San Carlos that were not diagnosed, making our risk estimation conservative.



The general excess in all cancers argues against a specific toxic agent which might be expected to affect the incidence of only one or perhaps a few cancer sites. However, epidemiological studies (Blot et al., 1977; Gottlieb et al, 1982; Kaldor et al., 1984; Olin et al., 1987; Pan et al., 1994; Nadon et al., 1995; Mastrangelo et al., 1996; Yang et al., 1997; Knox and Gilman, 1998) have reported different types of cancer being associated with occupational or residential exposure to oil pollutants. These cancers could be grouped in six systems: digestive (buccal cavity, pharynx, stomach, liver), respiratory (nasal cavity and lung), urinary (prostate, bladder, kidney), dermal (skin), blood (leukaemia) and others (brain, bone). In our study, all diagnosed cancers - except cervix - can be included in these groups.

The main known risk factors for the most frequent cancer found, the stomach, are cigarette smoking, alcohol drinking and diet. However, none of the three cases were smokers. San Carlos has a rural population, with diet based mainly on the consumption of rice, cassava, banana, meat and occasionally fish. No data on alcohol ingestion were available.

One possibility to explain any excess risk near an industrial source is that it reflects occupational rather than environmental factors. However, just one of the patients worked in an oil facility. There is no other industrial process in the area, apart from oil, that is suspected of entailing exposures causing cancer. The long residence time of the patients in the study area is consistent with a possible environmental carcinogen due to the long latency time that most of the carcinogens known are required (International Agency on Research Cancer, 1989).

The excess of morbidity was present only in men and only men had died of cancer. The reasons for the higher cancer incidence and mortality in men in our study are unclear. Six of



the patients (and one more deceased in April 1999) had already died; most of these deaths took place short time after the diagnoses. These data suggest either a great aggressiveness of the cancers or may reflect the poor access of the population of San Carlos to ameliorative health services.

There is also an uncertainty over the comparability of the Quito population and the local population. Access to health services, socio-economic and other possible unmeasured factors might confound the risk estimates. For some cancers, such as the larynx and skin melanoma, there is the added problem of possible residual socio-economic confounding which could not be measured due to the lack of data.

In summary, there is evidence of severe contamination of water sources and apparent excess of cancer morbidity and mortality in the village of San Carlos. The excess of cancer could be linked, as local people suspect, to the pollution of the environment by toxic contaminants coming from the oil production.



## **PART THREE**

### **UNDERSTANDING THE POPULAR EPIDEMIOLOGY PROCESS**



## **CHAPTER EIGHT**

### **THE DIALOGUE BETWEEN THE EPIDEMIOLOGIST AND LOCAL ORGANISATIONS**

Participation is a key aspect of popular epidemiology: it is an approach which demands that participants perceive the need to change and are willing to play an active part in the research. In popular epidemiology, “researcher” and “researched” are seen as equals and the epidemiologist work as a facilitator of the research but the ownership of the process remains in the community or organisation.

The research design must be continually negotiated with participants and practical agreements on the control of data and their use are developed. In popular epidemiology the dissemination and discussion of research results with involved communities is an essential step in the process (Brown, 1992). A dialogue between the epidemiologist and local organisations and communities is important when discussing the meaning of results and the dissemination of them.

The thesis initially presented the background of the epidemiological study described in part two. This chapter will examine, from the point of view of the epidemiologist, the joint dialogue established between the epidemiologist and the communities during the research process and reflect over practical and personal dilemmas faced. Emphasis will be given to how the results were disseminated and communicated. The popular epidemiology framework is used as an inspiration for exploring the characteristics of the process.



## 8.1. THE PURPOSE OF THE STUDY

The popular epidemiology process always starts with the concerns the community or local organisations have (Watterson, 1994; Macaulay et al., 1999; Arcury et al., 2000). Communities invite the epidemiologist to participate in their study. The process might then develop in different directions with more or less involvement of communities and local organisations. The definition of the research problem arises from an interaction between the community concern and needs and the epidemiologist's knowledge, leading to an exchange between the community pragmatic, concrete knowledge of the environment and health and the epidemiologist academic knowledge and experience (Mergler, 1987; Israel et al., 1998).

In our case, *FDA* was looking for “evidence” that there was an association between oil contamination and adverse health effects. They hoped that the study could be used in encounters with authorities such as companies and government officials as well as serve the purpose of deepening the understanding of the issue among communities and local organisations. *FDA* needed material in order to support the continuation of the work for the right to a cleaner environment. It was clear for everyone living in the area that there was a contamination that had gone on for too long. It had none of the news attraction as an acute oil spill in the sea such as the recently experienced on the Galapagos islands (The Guardian, 2001), but suffered from being a chronic problem to which the outer world did not pay much attention. The study therefore needed to be understandable and accessible for *FDA* and communities and the study also needed scientific credibility in order to be of potential use as “evidence”.

The activities of the peasant movement, which started to take form in the beginning of the 1990s, had been ongoing. It is important to remember that there were activities happening in



parallel to the study, such as workshops and meetings, and the study was one among other steps to continue the claims for a better environment. Some of these activities have focused on other problems of the oil companies such as violation of land rights and contracts.

## **8.2. PREPARING THE GROUND**

### **8.2.1. The *RMA* / epidemiologist rapprochement: depending on trust and independence**

One of the most frequently mentioned challenge to conduct effective popular epidemiology is lack of trust and perceived lack of respect, particularly between epidemiologists and community members (De Koning and Martin, 1996; Israel et al., 1998). The background of the epidemiologist was a key factor in the rapprochement between him and the *RMA*. He had lived many years in the area and been working with community health worker organisations and was linked to the catholic mission, *Vicariato de Aguarico* (VA). The mission had been active in social work in the area for more than fifty years and had a good reputation. He knew the environmental problems the people faced and he was well-known in different communities and by the different organisations belonging to the *RMA*. The fact that the epidemiologist belonged to an independent organisation (IESCMA), linked to the *VA*, opened many doors when establishing relationships and probably encouraged *RMA* to approach him asking for help.

Time is also considered as a main factor to establish relationships between the research partners (Arcury et al., 2000). Popular epidemiology requires time to gain organisation/community recognition, to exchange information with the community through meeting and forums, to build relationships when research is being planned and the continued investment of time to maintain these relationships throughout the research. The time schedule was not seen as a problem in this case as the epidemiologist was used to the rhythm and time



schedules needed when working with communities. The epidemiologist was also present and available throughout the research process which contributed to close collaboration between the two partners.

Some authors have argued that the research process might be strengthened by local, jointly negotiated, ethical codes or agreements that ensure the sharing of leadership, power and decision-making from design to dissemination (Willms et al., 1996; Macaulay et al., 1998). The relationship between *FDA* and *IESCMA* was built on trust. There were no written contracts or agreement signed between the partners. However, verbal agreements on the roles and responsibilities, desired outcomes of the research, control of the use of data and channels to disseminate findings were reached through regular meetings. There are obviously potential problems with verbal agreements in case of a change in leadership of local organisations or career moves of individual researchers. The relationship might also be more vulnerable to external pressures from other groups and commercial interests (Cornwall and Jewkes, 1995; Israel et al., 1998).

One important prerequisite for cooperation between researchers and communities is to have a place where to meet on “equal footing”. Universities and research institutions are alien environments to most people (Starrin and Svensson, 1991). For instance, an agreement was reached between the University of Quebec and two major trade unions. This agreement gave the union access to the human and physical resources of the university and the university received requests from the union for projects involving teaching and research (Mergler, 1987). Transport and meeting time have also been referred as challenges to be taken into account in the participatory process (Arcury et al., 1999). No such problems arouse in our



research. Meetings between the *FDA* and the epidemiologist were held equally in the *FDA* or *IESCMA* offices and in the communities.

When later *RMA* ceased to exist, the relationship continued with *FDA*. There were however smaller local organisations that wanted to be involved in the research but in the process of the split had difficulties in their relationships with *FDA*. During this period, it therefore became apparent that it was important for the epidemiologist not to affiliate too close to the *FDA* but to keep a good relationship from an independent stand. If not the integrity of the epidemiologist might be questioned. The epidemiologist and *IESCMA* also wanted to continue and in some cases start activities together with groups independent of the *FDA*. For instance, the *IESCMA* has been asked to assist other peasant organisation and unions to investigate health effects of pesticide use.

### **8.2.2. The symbiotic relationship between communities and epidemiologists**

Popular epidemiology or participatory research is often presented as an altruistic gesture on part of researchers in the service of communities. This is however a simplistic concept and does not recognise that researchers and scientists have their own goals and objectives. The ensuing community / epidemiologist relationship can best be described as symbiotic, with both parties gaining from the exchange (Mergler, 1987). It is important therefore to note that not only was there an interest from the communities' side to conduct the study. There was also an interest from a scientific and personal point of view, because of the lack of data on health effects of oil contamination and the study would form the base of a PhD thesis for the epidemiologist.



The popular epidemiology is community driven but attending to how communities' and epidemiologists' needs in the research process are similar and different, it is possible to arrive at a partnership that is satisfying and mutually beneficial (De Koning and Martin, 1996; Northridge et al., 1999). If the epidemiologist's needs compromises the needs of the community it is hard to see how trust and communication can be developed. The need of the communities has however to be in line with the interest of the epidemiologist for a fruitful collaboration to take place (Arcury et al., 2000).

### **8.2.3. Conflicts over funding**

Public health research has historically not attracted the levels of funding available to more prestigious areas of medical and scientific research. Many granting institutions that fund public health research have established priorities for studies that examine categorically defined physical health problems, involving individualistic intervention approaches, focusing outcomes on morbidity, mortality and risk factors, using traditional research design in which the expert researcher defines the problem and the methods used and occurring within a specific and limited time frame (Mittelmark et al., 1993; Whitehead, 1993). In addition, most funding sources have deadlines for grant submissions that do not allow for the time needed to develop trusting working relationships and collaborative applications (Israel et al., 1992). Grant support from government agencies and private foundations is less likely to fund scholars who urge community participation and who challenge scientific cannons and government policies (Brown, 1992). Although NGOs and charities may allocate some of their funds to these kind of activities funding remains a major obstacle (Watterson, 1994).

Funding is even more complicated in developing countries where a lack of resources for research is common. The *FDA* had no money to fund the research. *IESCMA* had to look for



money to do the research. It was a difficult task but enough money was found to cover the costs of the fieldwork of the study. However, it had a positive effect in that no conflicts over funding arose between *IESCMA* and *FDA*, each of them managing their own resources. Some authors argue that conflicts might arise when universities or health departments are the fiduciary agents of the funds. When this is the case, their structured financial systems can make the transfer and reimbursement of funds to community partners into a cumbersome, time-consuming, and seemingly disrespectful process (Plough and Olafson, 1994; Buchanan, 1996).

### **8.3. DEFINING THE PROBLEM AND RESEARCH DESIGN**

#### **8.3.1. Interaction between *FDA*'s concerns and epidemiologist's knowledge**

The very existence of *FDA* originated in the problem faced by oil contamination. Initially, *FDA* was created with the aim of supervising the trial against Texaco oil company (appendix 3). Later, *FDA* got involved in meetings, workshops and campaigns that strengthened the movement. The way forward in the research process was decided upon the interaction between the knowledge and concerns the *FDA* had over health impacts of oil contamination and the academic knowledge provided by the epidemiologist. This interaction was facilitated by the fact that the epidemiologist knew the area and its people. Although several meetings were held in order to prepare the study, this step would be much more time consuming if the epidemiologist did not know anything about the reality of the people he / she will work with (Parker et al., 1998; Arcury et al., 2000).

More than the existing knowledge of the epidemiologist, it was the accessibility he had to the academic world that became important. After a literature review was conducted, it was clear that even if there was some data published about the health effects of oil pollutants, no studies



had been done of populations living in the proximity of oil fields. The use of knowledge and information of local organisations and communities does not preclude the use of scientific literature and the review of earlier studies when formulating the research questions. A literature review might reveal that sufficient information exists to answer the research question. If it had been found that several studies in similar settings had been conducted, the next step might not have been to conduct yet another one, but rather using existing information and direct new activities in another direction.

### **8.3.2. Which method should we use?**

Some critics might argue the study was biased and weak because of the involvement of the epidemiologist with the local organisation and communities (Brown, 1992; Entwistle et al., 1998). Other academics might argue that the research was not “participatory enough” due to the methodology chosen (Cornwall and Jewkes, 1995).

Popular epidemiology has found success with a variety of methods. The selection of a method depends on the characteristics of the participants as well as on the type of information to be collected and the purpose for which the data will be used. Traditional epidemiological methods were followed in this research (Arcury et al., 2000). In dialogue with the *FDA*, these were seen as the most appropriate to support the objectives of the organisations. Local CHWs had already conducted a study in 1993. With a more traditional epidemiology study would allow them to express their claims in a “scientific” way. It was a way to transform their knowledge into “another language”, which could be recognised by authorities such as companies, lawyers and government officials.



What is distinctive about popular epidemiology is not the methods, but the methodological contexts of their application. The methods selected for study, the development of protocols, the questions to be asked within the protocols, the control of the studies so carried out, the criteria selected for interpreting the results, the communication of the results and their impact on policy are geared to community needs and not academics or scientific objectives (Watterson, 1994; Banner et al., 1995; Hecker, 1997).

It might be argued that an epidemiological study is narrow and that qualitative studies are called for in order to explain the complexity of the problem. It is then forgotten that in every popular epidemiology process the epidemiology is used as a tool and the epidemiologist enter into a dialogue with the communities. An epidemiological study forms a concrete contribution to the process the communities are involved in but is not trying to replace a social-political analysis. In an epidemiological study the epidemiologist and the community can meet in a point of common interest. Popular epidemiology brings together communities and epidemiologists in a joint dialogue.

## **8.4. EMBARKING ON THE STUDY**

### **8.4.1. Moving away from popular epidemiology?**

One of the characteristics used to identify popular epidemiology is the process by which lay persons gather statistics and other information (Brown, 1987). It has been mentioned that the involvement of community members in the actual conduct of the research enhances the quality of the process and the results (Israel et al., 1998). It may include, for example, involving community members in the development of research instruments (Parker et al., 1998), as well as hiring and training community members as interviewers for a community based survey (Eng and Parker, 1994). Problems to this involvement such as the tremendous



commitment of time have been highlighted (Israel et al., 1992; Parker et al., 1998). Cornwall and Jewkes (1995) also remind us that in some contexts it may be totally inappropriate to engage local people in certain elements of research. For instance, non-locals were employed to collect sensitive data on HIV in Uganda, due to the stigma of HIV/AIDS (Seeley et al., 1992).

The design of the epidemiological study was cross sectional and resembled any classical epidemiological study. There was no involvement by the *FDA* during the data collection, the epidemiologist was assisted by two community health workers during the study. There was no involvement by the organisation either in the data analysis. These decisions were taken after discussions between the *FDA* and the epidemiologist about the methodology to be used.

The study was presented to the participants as a general study of their health status. We then move into an interesting discussion within the popular epidemiology process. Did the epidemiologist at this point betray the principal of participation in popular epidemiology by obeying to the epidemiologist's wish to minimise bias? The women of the study were in this moment used as "research subjects". Not only were the women unaware of the hypothesis of the study but the methodology of the sample denied some affected communities the opportunity to participate. Communities sample for the epidemiological study was randomly selected. This concept was a bit difficult to understand for the members of the *FDA* Board, who represented several communities that were not selected for the study. After discussion of the epidemiological methods, the Board of *FDA* agreed to the design.

Popular epidemiology involves a collaborative partnership in which all parties participate as equal members and share control over the different phases of the research process. However,



the amount of power that each group has might vary during the process. The modes for involvement in each level are potentially unlimited and can be unique to each research. Because of the pressure from oil companies and government to present data on health effects of oil pollution, *FDA* chose in collaboration with the epidemiologist to conduct an epidemiological study which meant systematic procedures for sampling and sample selection. It also meant to give the control of the research process to the epidemiologist until the analysis of the study was done.

Although the collection of data followed a study protocol, the interaction and conversation with the people continued to be important. For instance, the cancer cluster investigation was initiated because of a health worker concern expressed when her community was visited by the research team.

## **8.5. COMMUNICATING AND DISCUSSING THE STUDY FINDINGS**

### **8.5.1. Communicating to FDA**

The first study to be analysed was the cancer cluster in San Carlos followed one year later by the results of the cross sectional study. Once the analyses were finished, data were given and discussed with the *FDA* Board.

In the case of the cancer cluster, limitations from this kind of studies were explained and the need for further studies to confirm the results.

The *FDA* Board asked the epidemiologist if it would be possible to prepare a written report in an understandable way with the results and conclusions so they could have a material to



present to communities and media as well as to use in workshops (San Sebastián and Córdoba, 1999).

The epidemiologist suggested to translate it to English first in order to have the results reviewed by the LSHTM. The *FDA* argued that time was important and it was a good moment to disseminate the findings. The president of *FDA* said:

*“In a meeting with government last year we argued that oil could cause cancer in communities surrounded by oil fields but they asked for data. We have now the data and we need to spread them ...”*

The second study followed a different process. The results were analysed and reviewed by experts at LSHTM. *FDA* asked again for a full report including the cancer findings. This document was named *Informe Yana Curi*<sup>17</sup> (“Yana Curi” Report). The “Yana Curi” report, 110 pages, described the oil contamination in Ecuador, presented a literature review on oil and health and the epidemiological study (San Sebastián, 2000).

The *FDA* did give some suggestions to the first drafts of the cancer cluster report and the “Yana Curi” report but it was the epidemiologist who was responsible for the writing. Although it was difficult to try to simplify technical explanations and concepts, the interaction with different community leaders and the long experience of the epidemiologist in the area working in primary health care programmes contributed to make this task easier.

Once *FDA* decided that the written report was going to be used in the dissemination process,

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<sup>17</sup> “The black gold”, translated from the local indigenous language.



drafts of the documents were sent to *FDA* Board but also to other colleagues and leaders of local organisations for review and comments. Overall, some clarifications were asked for regarding technical terms, especially statistical terms, and how to read some of the tables. However, there was an overall agreement that the report was well written and understandable by lay people.

After discussions between *FDA* and the epidemiologist, it was decided that the name of *FDA* would appear neither on the cancer cluster report nor on the “Yana Curi” report. This decision was based on the thinking that the report would carry more weight and reach a broader audience if it was presented as an independent report.

The importance of trust in the communication of results can not be overlooked. While there was a request from *FDA* to the epidemiologist to clarify some epidemiological terms there was never any doubts about that the message of the “Yana Curi” report was supporting the case of the communities. There was a common understanding that if the epidemiologist had in the analysis of the epidemiological data found something that was not in line with the hypothesis of the *FDA*, he would report that clearly and discuss any consequences of the release of such data. In some cases, communities have requested, and epidemiologists agreed, that publication would include dissenting views of both epidemiologists and community if the partners cannot agree on the interpretation (Macaulay et al., 1998).

#### **8.5.2. When and how to release the results**

After the study results were explained and discussed with the *FDA*, they wanted a quick release of the study findings. There was never any hesitation. This might be partly due to the fact that there was no controversy between the epidemiologist’s interpretation from an



epidemiological point of view and the understanding the *FDA* had beforehand of the relationship between oil pollution and adverse health effects. There was therefore never a need to go into a discussion of the “magic” significant levels set by the epidemiological community ( $p < 0.05$ ) (Graber and Aldrich, 1993). Epidemiological studies that find serious health problems seldom suffer from lack of credibility in the public arena. The scepticism comes when the opposite occurs (Sandman, 1991).

In discussions with the *FDA* Board, plans to disseminate the report were made and some agreements reached:

- The *FDA* would be responsible for disseminating the results and planning actions regionally among its organizations and with other national environmental groups. The *Centro de Derechos Económicos y Sociales, CDES*, would be contacted and asked to help them in the dissemination process nationally and internationally.
- *IESCMA* and the *Vicariato de Aguarico* would be free to disseminate the results to communities and organizations not linked to the *FDA*.

It meant that the *FDA* had the power to go ahead with dissemination of the results in the communities before any publication of the data. For the epidemiologist it meant to give power away. This is a point when the popular epidemiology process clashes with the conventional way of disseminating research results where the epidemiologist is usually in charge of when and where the results should be presented. The power of local organisations to control when and how to release data visualise the potential tension between the slow dissemination time schedule driven by the organisations of academic institutions and journals and the quick communication requested by activist groups.



*FDA* decided to make 500 copies of the cancer cluster report. Because it was a preliminary report, this was made in a local photocopy machine and the *VA* paid for it. Five hundred copies were also printed of the “Yana Curi” report to distribute to local organisations, government officials and the media. It was published through a well-established national editorial, which made the report available in bookstores in Quito. The printing was funded by the Spanish NGO *Medicus Mundi Guipúzcoa* (photo 8-1).

The *FDA* pointed out that the “Yana Curi” report might be a bit complex and long to read for many peasants (and not peasants) and they asked the epidemiologist to do a leaflet of two pages with the main results and conclusions of the study (appendix 8).

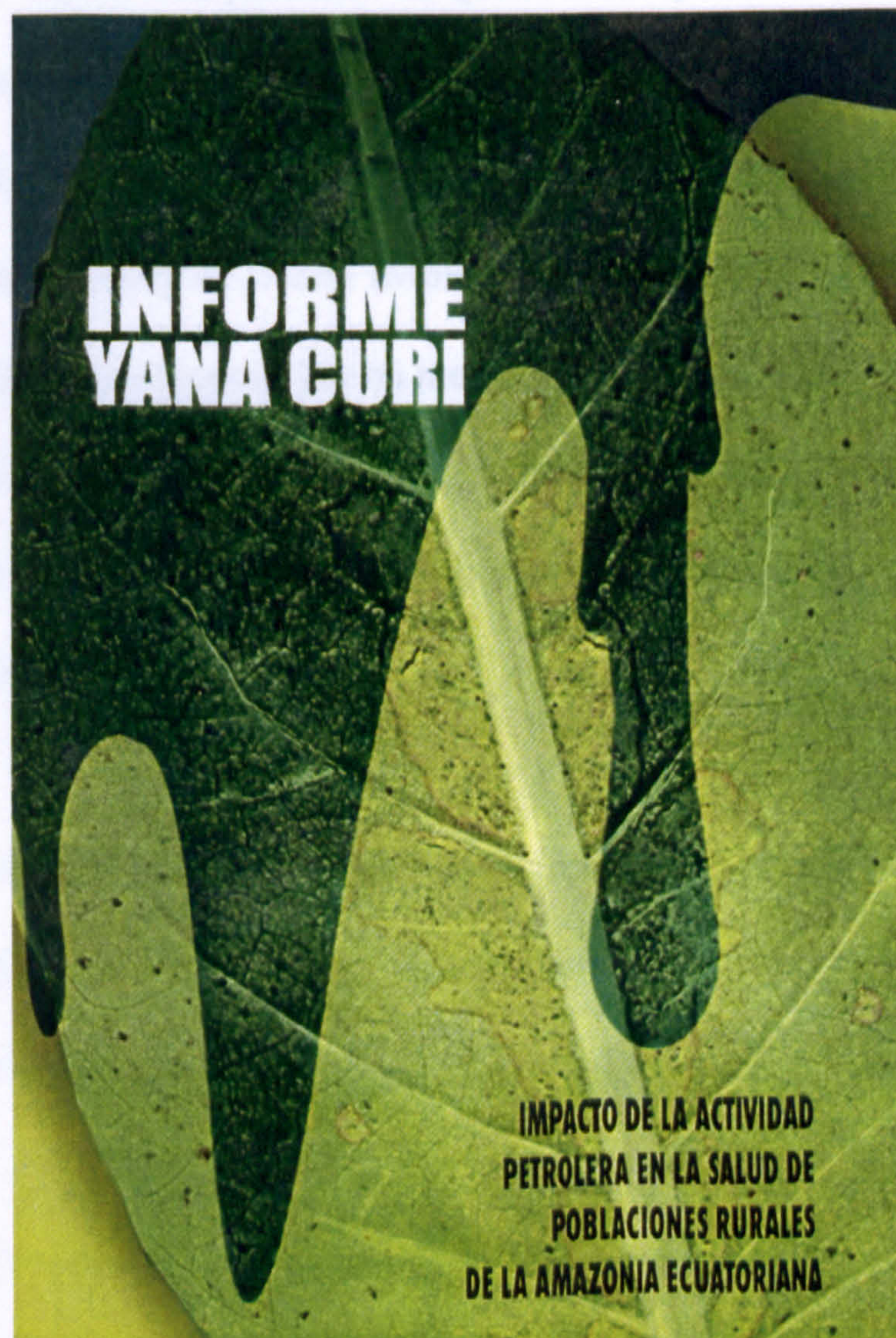
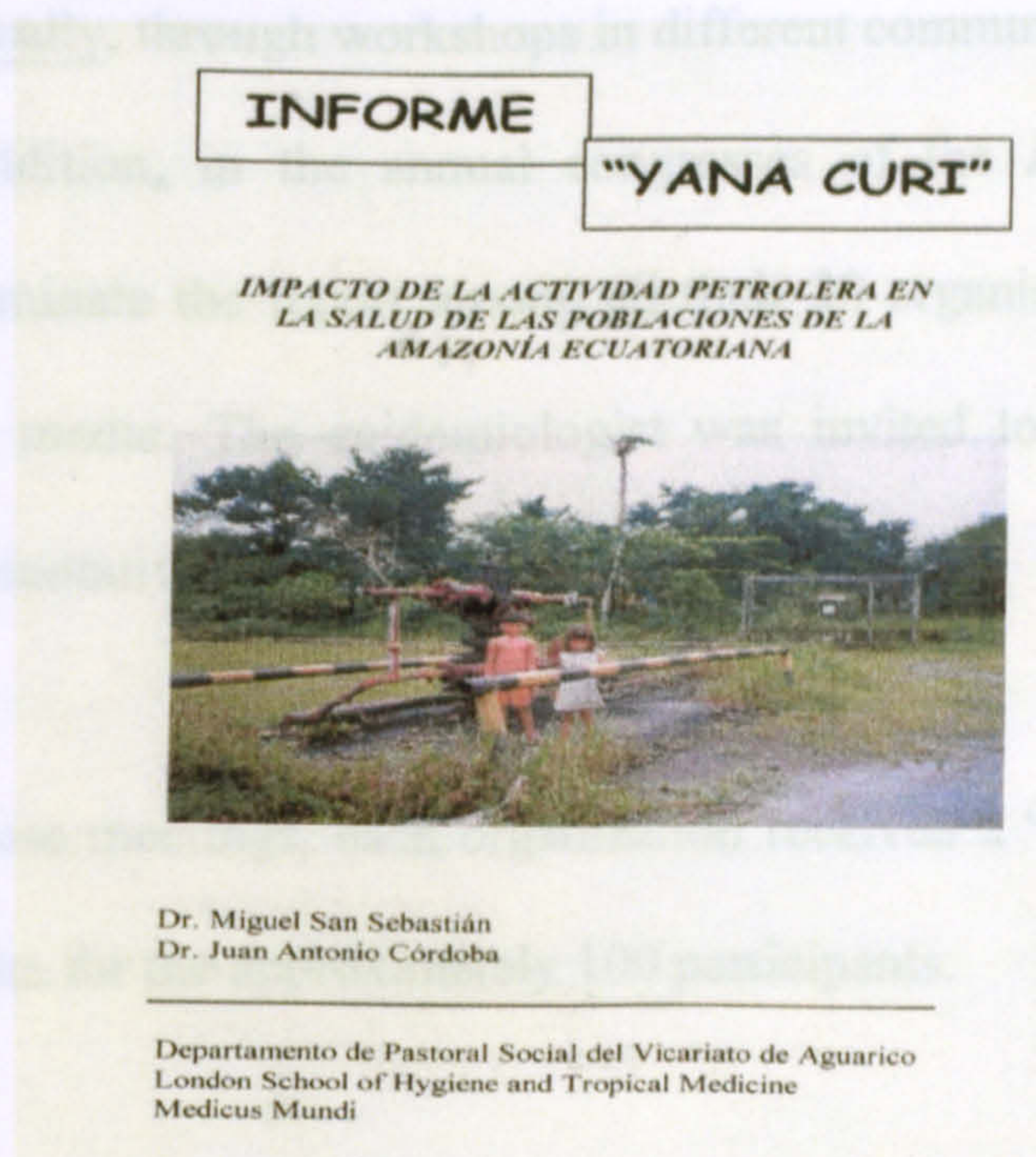
To simplify the content in the leaflets was a difficult task due to the risk of distortion of the epidemiological information. In popular epidemiology, however, simplification should never be an excuse for failing to provide information that is “too complicated”, and completeness should never be an excuse for bewildering people with more than they can master.

### **8.5.3. FDA disseminates the findings**

*FDA* wanted the results of the study to be disseminated as broad as possible. They wanted to inform communities that they had new information linking oil contamination and adverse health effects. They also wanted to show the government the need of a change in the way oil companies were operating. In order to press the government for action, *FDA* wished to call the attention of media and national and international environmental groups.

*FDA* used three levels of dissemination of the results:





**Photo 8-1. Front pages of the cancer cluster report and the "Yana Curi" report.**



(i) locally, through workshops in different communities according to the schedule of the *FDA*. In addition, in the annual congresses of the *FDA*, the Board took the opportunity to disseminate the report among all their 20 organisations, national environmental groups and local media. The epidemiologist was invited to present and discuss the results with the representatives of the organisations.

In these meetings, each organization received a “Yana Curi” report for free and there were leaflets for the approximately 100 participants.

(ii) nationally, the “Yana Curi” report was presented in Quito. The report was introduced by the president of the *FDA*, the bishop of the *Vicariato of Aguarico*, the representative of *Medicus Mundi* in Ecuador (the funders of the study and report) and the National Director of Environmental Health from the Ministry of Health (MoH) of Ecuador. In this case, national environmental groups and academic institutions but no media were present.

*FDA* sent also the report to the main newspaper and radio stations of the country and took the opportunity to disseminate the results in meetings held with government officials in Quito to talk about environmental issues.

(iii) internationally, through meetings held by the *CDES* with international organisations such as the World Bank or the Amazonian Confederation of Indigenous People and by sending the report to the lawyers in the Texaco case (see appendix 3).

The epidemiologist played as well a role in the dissemination process of the results. The epidemiologist was available to *FDA* and he was invited to numerous community meetings to present and discuss the findings. The cancer cluster report was introduced to the MoH in



Ecuador where several National Directors (epidemiology and environment health included) were present. Furthermore, the epidemiologist suggested to *FDA* the possibility of disseminating the results of the epidemiological study to the “scientific world” through medical congresses and peer reviewed journals. The *FDA* agreed that this could be another important channel for dissemination. One immediate action was to send three abstracts to the Congress of the International Society of Environmental Epidemiology (ISEE) to be held in August 2000 in Buffalo (USA) (San Sebastián et al., 2000a; 2000b; 2000c) and prepare articles for peer-review journals (San Sebastián et al., 2001a; 2001b; 2001c).

#### **8.5.4. The example of San Carlos**

This section will present what happened in San Carlos village as an example of how *FDA* communicate the findings of the study to their community members and the role the epidemiologist played.

San Carlos village is comprised of a small urban center and surrounding rural neighbourhoods. The village has a committee lead by a President and further ten members representing the different neighbourhoods. The committee invites the village to open meetings each two month in order to discuss issues related to the community. The meetings take place in the church and usually are attended by around 100 residents (see section 7.4.1.1). Texaco oil company together with Petroecuador (the national company) operated in San Carlos village during twenty years. In the last ten years, only Petroecuador has been operating in the area. During this period San Carlos had at times a tense relationship as very little compensation was given to the village for the exploration activities conducted and people had become more aware of the contamination (Garzón, 1995; Press, 1999).



The cluster investigation in San Carlos (section 7.4) was not planned but became an important part of the research. Investigation of a cluster often starts with questions from worried citizens or communities. A reported cluster is best seen as a common problem for the involved community and the responsible authority or researcher. Cluster management then becomes a common endeavour as well. The interests of the concerned community and the responsible authorities and researchers should coincide as much as possible and in order to achieve this they should work together as much as possible (Graber and Aldrich, 1993; Drijver and Woudenberg, 1999).

The US Centers for Disease Control (CDC) has published a manual with guidelines for investigating clusters of health events (Centers for Disease Control, 1990) which also states that cluster investigator should understand the various ways in which individuals respond to stressful situation and react to uncertainties. Investigator also should be able to recognise the source of inevitable community suspicions and demands. Drijver and Woudenberg (1999) have noted that people in these circumstances judge the messenger more than the message and the following demands to researcher are posed: (i) expertise: being knowledgeable, but also able to deal with uncertainties and premises; (ii) credibility: being credible and trustworthy and, (iii) empathy: being receptive to emotions.

The epidemiologist of the *IESCMA* who carried out the cluster investigation in San Carlos worked closely with the community. Several informal interviews were held with the patients and persons who had lost family members to cancer.

In the beginning of May 1999, the results of the cancer study were presented to the village of San Carlos in a community meeting by the epidemiologist and the *FDA*. The small printed



report was given to representatives of the village. The elevated concentration of petroleum found in the rivers of the village and the high rates of cancer when compared to the national rates were explained to the community. Potential reasons to link the cancer incidence with the oil contamination were given and limitations of the study discussed (section 7.4.3). Overheads and a blackboard were used to help in the discussion.

Different questions by men and women of the village were raised during the meeting. *“I did not know that there were so many cases in the village” “How can you get sick from oil?” “Is it from drinking the water, or from breathing the air?” “Can we know who will be next?” “Could we do something to prevent this?” “Is there a medical exam to diagnose who has the risk of getting cancer?” “Who will be next?” “What can the company or government do to reduce or eliminate the problem?”*

It took several hours for the epidemiologist to go through all of the questions till the people could draw the meaning of the study. This is a normal process among communities where a cycle of explanation, discussion and again explanation is repeated several times using different angles. The epidemiologist was used to this dynamic when talking with a community from his previous experience in the area.

In the meeting, the *FDA* highlighted the importance of the study in a context of lack of data and explained the efforts the organisation was making to support the communities.

Some local residents argued the need to be better organised, the interest on receiving more information and being more involved with the *FDA*. *FDA* promised to assist in the pressure



on the government and oil companies to improve the conditions of the village and to support them in their demands.

One year later, the *FDA* invited the epidemiologist to present the results of the “Yana Curi” report in San Carlos village. The meeting took place in the church and was attended by around 200 residents. The results were discussed: how the study was suggesting that women in the village were at higher risk of adverse health effects and spontaneous abortion than women living where no oil fields existed. Again, transparencies and a blackboard were used and leaflets on the study were distributed to all present.

This time however, the discussion did not focus on the health problem. During the meeting, many residents expressed their anger because almost one year after the first cancer report, no first step to action had been taken. One middle-aged peasant raised to his feet and said:

*“We can’t continue like this...we will all be sick. We must make it clear to Petroecuador that this can’t go on...”*

Some community members asked the *FDA* if there was any possibility to do something to force the company to change. The lawyer of the *FDA* explained the different legal possibilities against the national oil company, Petroecuador. He said it would be difficult because nobody had yet put a trial against Petroecuador for environmental and health damages in the country.

*“However, if the community wants we can initiate the judicial process. But first of all, the community must think carefully and you need to be united. If not, we will not succeed.”*



The committee of San Carlos decided that they would call the *FDA* again after further discussions in village.

#### **8.5.5. Local organisations: the problem of representing communities**

Popular epidemiology stresses the relationship between the epidemiologist and community, the direct benefit to the community as a potential outcome of the research and the community's involvement in itself beneficial (Dressler, 1993; De Koning and Martin, 1996). However, the presented study points at the potential difficulties in working with communities as it usual means working with a local institution. "Working with communities" often is used when in reality the work is being conducted jointly with local organisations representing communities (Herbert, 1996; Matsunaga et al., 1996; Jewkes and Murcott, 1998). To work with local organisations has both advantages and disadvantages. A local organisation often has more resources to mobilise and might be formed to confront a special problem such as *FDA*. It might be essential when it comes to translate the research into action (Arcury et al., 1999). However, local organisations might have their own agenda and in reality not representing the community (Cornwall and Jewkes, 1995). The epidemiologist might then find himself and herself in a conflicting situation wanting to confront the organisation with which the agreement is made. The importance of knowing the local situation is therefore important and to be aware of the importance of enmities and informal relationship in the progress of the research (Israel et al., 1992; Plough and Olafson, 1994).

Many of the communities in the area, including San Carlos, had during many years been fighting for their rights of a clean environment. The communities were however often unable to stand up for their rights confused by legal procedures, technical terms and contracts. The *FDA* formed an organisation to which they could turn for help.



A local organisation is able to transform will to action by concentrating resources and affiliate itself to legal and scientific expertise. A local organisation can represent many communities or individuals that suffer the same problem. That was also the case with this research. *FDA* represented San Carlos but also a number of other communities. It is therefore not a surprise that when the discussion comes to how the action should follow on to the research findings there can be a conflict between the local organisation and the community. Who is representing the community and how this is being done becomes a crucial matter in the process of popular epidemiology.

The dissemination process can find special difficulties in rural settings of developing countries. The accessibility to the communities by the informants or the access of the communities to media or meetings may be reduced. In this case, one more factor was added: the organisational structure of the *FDA* (see sections 1.3, 4.1). Many communities in the contaminated area were not represented by the *FDA*. With permission of the *FDA*, an effort was made by members of the *IESCMA* and personal from the *VA* to disseminate the information in the communities not related to the *FDA*.

#### **8.5.6. The value of being “scientific”**

Popular epidemiology must ultimately result in scientifically valid and meaningful results in order for their conclusions to be accepted and acted upon by the larger public health, regulatory and scientific communities. The degree to which science that was conducted with community participation achieved professional and disciplinary standards is extremely important for the process.



*FDA* wanted a study to be considered “scientific” to be presented at different institutional levels in order to show what was happening to their health. *FDA* was aware that oil companies would also challenge the scientific rigour of any study. The diffusion in the scientific world serves to give scientific credibility to the work. The involvement of an internationally recognised academic institution like LSHTM became important and used as a proof of validity by media. Therefore is the publication and presentation of these epidemiological studies in an academic setting also of direct benefit to the popular epidemiology process (Arcury et al., 2000). For instance, the researcher presented the study in the International Society of Environmental Epidemiology conference 2000 in Buffalo. It became clear that this was actually not so much in order to widen the diffusion but rather to ensure the works credibility. A credibility which was not only important for the epidemiologist own interest, but as well for the *FDA* / communities in order to be able to use the study.

During the course of the research, the affiliation to LSHTM through the PhD degree gave the epidemiologist access to experienced professionals. The advises from statisticians, epidemiologists and environmental policy specialists increased the validity of the epidemiological study and the research as a whole.

## **8.6. DID THE STUDY ACHIEVE ITS PURPOSE?**

It is outside the scope of the thesis to analyse the action inspired by the study. However, the village of San Carlos was an example of a community that was “ripe” to take action. They had a long experience of oil companies and had had very little compensation from them. Many families had experienced the contamination of their water sources, deaths of cancer and skin problems were common. After the dissemination of the cancer cluster report there was



intensive media coverage from local, national and international media (see appendix 9). During this period the demand for change grew strong and they confronted *FDA* for being too slow. San Carlos followed its own process and did decided to initiate a legal process against the national oil company, Petroecuador, because of the environment and health problems in the village.

*FDA* has also taken the fight to another scenarios. In the last two years, *FDA*, together with the Ministry of Energy and other national environmental groups, has been actively participating in the formulation of a new document on “Environment Regulation for Oil Operations in Ecuador” lobbying to introduce safer environmental standards. During this work, the “Yana Curi” report has been quoted frequently.

It is difficult in a short-term to say what impact the study will have on the overall process of claim making. The power of epidemiological studies to change policy has been discussed (De Leeuw, 1993; Walt, 1994; Atwood et al., 1997; Krieger, 1999; Marmot, 2000). However, epidemiological studies that are based in community concern and where the communities have control over information are likely to have greater impacts as the population affected can use them in their claims (Wing, 1998).

## 8.7. LESSONS LEARNT

- There is not one “correct” method in developing popular epidemiology. The key is the dialogue and the sharing of power between the epidemiologist and communities / local organisations. The epidemiologist should not underestimate the power he / she has, especially during the epidemiological study, and a continuous dialogue should be maintained to minimise the gap between communities and researcher.



- Even if oral or written agreements are made between the epidemiologist and local organisation / communities during the research process, trust has to be felt from both sides for the research to be successful.
- Scientific credibility is important when local organisations / communities want to use the research as “evidence”. There is a need for conducting rigorous epidemiological and survey research that produces generalizable results to influence environmental and occupational policy and regulations.
- It is difficult to work directly with communities when they are diverse and many. Interest organisations facilitate the working relationship, but it is important to know who they represent and how they are structured in order to avoid conflicts.
- Time has to be put aside for dissemination and discussion of results. The researcher has to enter into the dynamic and timeframe of local organisations / communities.
- Local researchers have knowledge about local realities and are well suited to enter into the popular epidemiology process. However, it is important to build links between local researchers and national / international institutions in order to provide technical support. Training of local researchers is an essential component of the support academic institutions can give to facilitate popular epidemiology.



## CHAPTER NINE

### THE ROLE OF THE PUBLIC IN EPIDEMIOLOGY

The first edition of “A Dictionary of Epidemiology” defined public health as “*a form of political and social activism that aims to protect, promote and restore the people’s health*” (Last, 1983). Epidemiology is a cornerstone of public health (Institute of Medicine, 1988; Last, 1995). Despite this, during recent years epidemiology has been criticised for having lost its public health context and social perspective (Pearce, 1996; Shy, 1997; Wing, 1998; Koplan et al., 1999; Editorial, 1999). This thesis has presented an epidemiological study done in relationship with the concerned communities and organisations. This experience has been embedded in the conceptual framework of popular epidemiology. The study stands by itself, however it became clear that the research process had potential implications for how to approach epidemiological studies of public health importance. In the light of this experience, the present chapter will place popular epidemiology in the current debate on epidemiology. It will argue that the popular epidemiology approach with its focus on lay involvement and control is essential when securing a key position for epidemiology in public health.

#### 9.1. THE CURRENT DEBATE IN EPIDEMIOLOGY

##### 9.1.1. The conceptual framework

The theoretical framework within which we formulate our research questions determines the scope, content and social relevance of our answers. The question of context has excited much recent debate about the mission and models of “modern epidemiology” (Rothman and Poole, 1998).



The past three decades have witnessed the methodological consolidation of “modern epidemiology”, with its particular orientation to study multiple risk factors for chronic non-communicable disease. That conceptual and methodological orientation arose from the mid-20<sup>th</sup> century as epidemiologists formally engaged in the study of disease of long latency, multiple causality and apparently non-infectious aetiology (Susser, 1998; McMichael, 1999). Faced with a diversity of disease and risk factors, they adopted an essentially empirical approach, establishing and testing hypothesis through carefully designed research methods. Numeric reasoning, based on statistical modelling, was central to the effort. This approach has had some remarkable success in discovering the pattern and aetiology of disease, but it is less well equipped for understanding the complexities of many aspects of health (Baum, 1998). The growing realisation that health and illness reflect the structure, culture, power relationships, economy and politics of a society has resulted in public health seeking to understand more about health and disease than the immediate cause of any particular disease (Wing, 1994; Kogevinas, 1998; McMichael, 1999; McKinlay and Marceau, 2000).

Shy has argued (1997) that as a basic science of public health, epidemiology should attempt to understand health and disease from a community and ecologic perspective. Health and ill-health are consequences of how society is organised and behaves, social and economic forces have impacts on disease incidence rates, and community actions will be effective in altering incidence rates. McMichael (1999) has stated that to understand the determinants of population health in terms beyond proximate, individual-level risk factors (and their biological mediators) requires a social-ecologic systems perspective. He continuously saying that modern epidemiology has largely ignored these issues of wider context. *“We have typically assumed that populations are merely aggregates of free-range individuals and that methodologically correct local studies can estimate presumed universal individual-level risk*



*relations. Such an approach, however, forfeits understanding of the cause and distribution of disease within populations and thus restricts the social usefulness of the research”* (McMichael, 1999).

Wing (1994) has proposed that epidemiology should recognise the historical contexts of public health phenomena and the sciences that address them in order to achieve a far greater level of social responsibility. In the same vein, Krieger (1994) has pointed out that the metaphor and model for epidemiology has been the “web of causation” through which it has become more and more concerned with modelling complex relationships among risk factors. She has urged epidemiologists to become more critical in their approach to the cause of disease, proposing an eco-social framework for developing epidemiological theory. Pearce (1996) has also stated that *“epidemiology seems to be using more and more advanced technology to study more and more trivial issues, while the major population causes of disease are ignored. Epidemiology must reintegrate itself into public health, and must rediscover the population perspective”*.

McKinlay (1994) has argued that what is now regarded as established epidemiology is characterised by biophysiologic reductionism, absorption by biomedicine, a lack of real theory about disease causation, dichotomous thinking about disease (everyone is either healthy or sick), a maze of risk factors, dogmatism about which study design are acceptable, and excessive repetition of studies. He has argued that this approach diverts limited resources, blames the victim, produces a lifestyle approach to social policy, decontextualizes risk behaviours, seldom assesses the relative contribution of non-modifiable genetic factors and modifiable social and behavioural factors, and produces interventions that can be harmful.



These trends have been observed, for instance, in the recent rise of molecular epidemiology (McMichael, 1994). Vandenbroucke (1994) has argued that the criticism of epidemiology is a repetition of old style rhetoric, with the same stubborn tactics that will lead to a new academic downfall. Mackenbach (1998) has noted that epidemiology should devote to study individual exposures and individual health outcomes, and leave the study of group level influences on individual characteristics to other disciplines such as sociology. Walker (1997) has raised the question if “there are principles of effective public health intervention that are not rooted in chemistry, physics, and biology?”. Rothman et al (1998) have expressed misgivings about the capacity of epidemiology to “eradicate poverty” by studying its role in disease causation and preferring instead to concentrate on poverty-associated, measurable, proximate risk factors for which clear-cut answers can be found.

However, examples of broader views of the scope and goals of epidemiology can be found throughout its history. In the mid 19<sup>th</sup>-century, Rudolf Virchow showed an example of a quantitative approach to understand disease in populations that, while recognising the importance of specific agents or exposures, did not reduce the explanation of disease to a matter of these isolated factors themselves. Virchow, in investigating an epidemic of typhus in Silesia, stressed the conditions that fostered the epidemic: lack of agricultural land, malnutrition, poor housing, low wages, and language barriers for the large Polish minority. His report to the government advocated land reform, progressive taxation, establishment of agricultural communes, local political autonomy, and, lastly, creation of a system of public hospitals (Waitzkin, 1981; Eisenberg, 1984; Taylor and Rieger, 1985).



### **9.1.2. The methods: towards multidisciplinary approaches?**

Recent decades have recognised that epidemiology is just one of the approaches (and not the gold standard) by which the major determinants of health in a population can be addressed, and it should be complemented by other qualitative approaches from the social sciences, as well as other disciplines within the public health field (Connelly, 1994; Baum, 1995; Pearce, 1996, Savitz et al., 1999). Wing (1998) has argued that epidemiology, as widely practised, has become a set of generic methods for measuring associations of exposure and disease in individuals, rather than functioning as part of a multidisciplinary approach to understanding the causation of disease in populations.

#### **9.1.2.1. Linking qualitative and quantitative methods**

Traditionally a gulf has been seen to exist between qualitative and quantitative research, with each belonging to distinctively different paradigms (Layder, 1988). The distinctions between these paradigms relate to a number of levels concerning the production of knowledge and the research process: epistemology, theory and method. However, the distinction is most commonly applied at the level of methods: the process of data collection and the form in which the data are recorded and analysed (Brannen, 1992).

Quantitative researchers typically criticise qualitative studies on the basis of being unrepresentative, using small sample sizes, and not being replicable. Qualitative researchers argue that large quantitative surveys lack the contextual detail necessary to interpret findings, and they ask superficial questions with a limited predetermined range of responses on structured questionnaires (Carey, 1993).



Public health problems result from complex social, economic, political, biological, genetic and environmental causes and a range of methods are needed to tackle them. Many argue that more programme collaboration between quantitative and qualitative researchers will result in the generation of knowledge that could be more directly use for public health interventions (Beaglehole and Bonita, 1997; Baum, 1998).

There are a number of existing examples demonstrating that a linkage between qualitative and quantitative methods is both possible and useful. Some researchers employ qualitative data to provide an explanatory historical context for empirical analyses. Others use qualitative data results as a means to validate or interpret findings from statistical analyses. Still other investigators use qualitative and quantitative data collection sequentially as a way to better design later stages in the research process (Boone, 1989; Garro, 1990; Jenkins and Howard, 1992; Hundt and Forman, 1993; Carey, 1993; Cairncross and Kochar, 1994).

It has been recognised that each method, quantitative or qualitative, has its own inherent strengths and weaknesses depending upon the topic under study and the research questions being asked (Baum, 1995). Yach (1992) has warned that “*qualitative methods themselves are certainly necessary to gain a deeper understanding of local knowledge, attitudes and beliefs about disease but are not sufficient, even combined with quantitative methods, if they are inappropriately derived using models and theories developed outside of the setting in which they will be used*”.

## **9.2. SETTING THE AGENDA: THE ROLE OF THE PUBLIC**

The “Alma Ata declaration” recognised that “people have the right to participate individually and collectively in the planning and implementation of their heath care” (World Health



Organisation, 1978). Many public health researchers have argued that, whenever possible, research should be participative (Wadsworth, 1984; Feuerstein, 1986; Baum, 1988, De Koning and Martin, 1996). This reflects partly a desire to reduce professional dominance in public health and partly the increasing recognition that lay people can offer a form of expertise not necessarily held by professional researchers (Popay and Williams, 1996; Baum, 1998).

However, in the current debate in epidemiology the role of the subject -the public-, in theory the group public health serves, has hardly been taken into account. Little space has been left for the public knowledge and understanding of the health, recognising the rights of those whom research concerns and enabling people to set their own agendas for research. This is despite the increasing recognition of the gap between the concepts and models professionals use to understand and interpret reality and the concepts and perspectives of different groups in the community (World Health Organisation, 1981; Wing, 1994; De Koning and Martin, 1996; Chambers, 1997; Meyer, 2000).

There is a growing recognition that collaboration between scientists and community members poses several distinct advantages:

Community participation increases the likelihood that the research will be culturally appropriate; its format and content will better fit the cultural systems of the community (Arcury et al., 1999). It also produces a more sustainable intervention that continues to be used by community members when outside health professionals turn their attention to other issues (Israel et al., 1998).



Community involvement can enhance the quality of the research, identifying important questions and relevant outcomes, drawing up priorities for research topics, appraising protocols, undertaking research, and interpreting research findings (Oliver, 1995; Arcury et al., 1999). Community involvement in generating knowledge may increase the perceived relevance and acceptance of findings. The inclusion of community perspectives may therefore lead to research findings being more fully implemented (Watterson, 1994; Entwistle et al., 1998). Community involvement can also produce a fundamental change in the orientation of researchers by making them better listeners and by making them more willing to invest the time and energy to meet communities on the communities' own terms (Israel et al., 1998).

Community participation can have an important role to play in monitoring "non-positive epidemiological studies", flagging up concerns and worries about hazards which could be investigated at an early stage, possibly to be discounted or put in context as insignificant risks at a later date. This would help to ensure that the possibilities of low level exposures leading to unforeseen ill-health are not forgotten by professionals (Watterson, 1994).

As Hatch and his colleagues (1993) summarise "*the opportunity arises for communities and science to work in tandem to ensure a more balanced set of political, social, economic, and cultural priorities, which satisfy the demands of both scientific research and communities at higher risk*".

Different authors have also drawn the attention to some potential pitfalls of the popular epidemiology process. Researchers may inadvertently collaborate with a minority section of the population that does not represent the collective interest of the entire community. The time needed for a research may exceed what the researcher can give; it may add to the cost of



the study. Researcher may be left with nothing if a community changes its priorities, as may communities if the researcher leaves for a career change (Jewkes and Murcott, 1998; Israel et al., 1998; Macaulay et al., 1999). It may leave the researcher open to political posturing, methodological bias, or at least the appearance of them, colleagues wondering about the scientific independence or credibility (Sandman, 1991). Another problem is unrealistic expectations for community based research; a one year research may not produce measurable changes in markers of conditions that developed over generations (Daniel et al., 1999).

Yet these potential pitfalls do not devalue the important part a participatory attitude and approach can play in epidemiology as a force for learning, empowerment and finally social change.

#### **9.2.1. Will the epidemiologist take on the challenge?**

The Institute of Medicine (1988) has defined public health as “*organised community effort to prevent disease and promote health*”. Beaglehole and Bonita (1997) have recognised that global progress in public health is closely related to the development of mass participatory democracy beginning at the community level and extending throughout society. True participation implies effective two-way consultation and joint ownership of public health research and programmes (Scally, 1996, Meyer, 2000).

Recently, the First Panum Lecture in Copenhagen (1999) discussed the future of epidemiology concluding that whatever levels the problems are addressed at (the macro, individual or on a micro level), the major challenge in the future for epidemiology will be to provide adequate evidence that can lead to implementation. Epidemiological findings on the causes and prevention of disease always have implications for health policy and public policy



more generally. Unfortunately, these implications are not always acted upon (De Leeuw, 1993; Walt, 1994; Atwood et al., 1997; Colditz, 1997). Popular epidemiology offers a bridge where the perspectives of the public and the researchers can be brought together facilitating the process where research findings can be translated into action.

The main characteristics of the popular epidemiology process lie in the research being initiated because of local concerns and in the ownership of the process by a community or their organisation (Arcury et al., 1999). This ownership does not necessarily mean to be involved in each of the different stages of the research process but to be informed, to be under control, to have the power of decision-making in each of the stages. Popular epidemiology acknowledges that "knowledge is power" and thus the knowledge gained can be used by all partners involved to direct resources and influence policies that will benefit the community (Israel et al., 1998).

Some authors have noted that if research is to enhance our understanding of the major public health problems of the next century, researcher – whatever their disciplines – will need to give more status to lay experts and begin to work together (Popay and Williams, 1996; Baum, 1998). This means to enter into a continuous process of interaction and involvement between researcher and the lay people whose public health problems have become the focus of concern.

Popular epidemiology covers a spectrum of endeavours dedicated to the involvement of local people in the research process. Ultimately popular epidemiology is about respecting and understanding the people with and for whom researchers work (Cornwall and Jewkes, 1995). Engagement in a participatory process forces researchers to confront complex choices and



multiple contradictions. Clearly, the overall conclusion must be that research aimed at improving communities' health should be committed to the sharing of power and control. As long as there is such authentic commitment, there is no one single best of conducting popular epidemiology, but the nature and degree of participation must be tailored appropriately to the specific research enterprise.



## CHAPTER TEN

### CONCLUSIONS

The research presented in this thesis was conducted in the rainforest in the north-eastern of Ecuador where oil companies have been operating since the 1970s. The contamination faced by the residents however is a result of decisions taken far away from their reality, often on other continents. This concluding chapter places the study results and research approach in a global perspective claiming the need of alliances between communities and researchers in order to protect health and environment. Implications of the study results are discussed.

#### 10.1. TRANSNATIONAL COMPANIES AND SUSTAINABLE DEVELOPMENT?

Globalisation, with its emphasis on the free movement of people, capital, services and goods, has diminished the role of government, while enhancing the power of corporate business (Walt, 2000). Many identify trade power as a major force within globalisation, currently exacerbating inequality and ill health (Bezruchka, 2000; Stephens et al., 2000). The latest report of the United Nations Environmental Programme (UNEP) suggests, that *“continued poverty of the majority of the planet’s inhabitants and the excessive consumption of the minority are the two major causes of environmental degradation. The present course is unsustainable and postponing action is no longer an option”*. According to UNEP, this unsustainable and unequal process is driven by the globalisation of transnational trade (United Nations Environmental Programme, 1999).



Many argue that corporate power is simply a logical result of a process of economies of scales in an inevitably competitive world. Further responsible action by these powerful economic interests is a key means of alleviating poverty (Fitzgerald, 1998; Wallach and Sforza, 1999). The World Business Councils for Sustainable Development (WBCSD) recognises that the environment is under increasing stress and economic development must occur in a way that is environmentally sustainable. The key point made is that trade and sustainable development objectives do not have to conflict with one another (World Business Council for Sustainable Development, 1998).

For instance, Shell oil company has recently published a social report that includes a clear commitment to sustainable development, which must be founded on economic progress, social development and environmental improvement. Business and investment decisions cannot be taken in isolation from the other two considerations (Shell Report, 2000). TNCs are now insisting that they have turned over a new leaf and are to become the guardians of what remains of our natural environment and promoters of the social and economic well-being of the communities in which they operate (World Business Council for Sustainable Development, 2001).

However, many are not convinced and think this is part of a strategy to enable TNCs to achieve their real goals, foremost among which is the setting up of a global free and ever more homogenised market for their products (Greer and Bruno, 1996). According to Finger and Kilcoyne (1997), the WBCSD is currently engaged in lobbying strategic national governments in the South, as well as multilateral organisations especially the World Bank, with the aim of determining and control global environmental and other standards, as well as trade rules. The TNCs' greatest "achievement" has been to establish the principle that



industrial development or economic growth, now referred to as “sustainable development”, is the only acceptable solution to global environmental problems, and that to maximise the pace of this process, international trade has to take precedence over all other considerations (Korten, 1995; Shrybman, 1999; Karliner, 1999).

#### 10.1.1. Facing the future

In the international context of changing environment and health policies, the overall links of trade, environment and health are paramount and a growing body of evidence is being collected that “development” activities should be undertaken with attention to impact on the environment and the health of local people. In the last years, three developments, each of which will become extremely important in the run up to the United Nations Summit Rio plus 10<sup>18</sup>, have been developed. These developments will be discussed bellow.

One interesting technical development, which may change the way development activities are assessed in future is the idea of bringing health impact assessment procedures together with environmental impact assessment procedures (British Medical Association, 1998). Health depends on society’s capacity to manage the interaction between human activities and the environment. To ensure that development promotes rather than endangers health, comprehensive impact assessments are required to integrate health and ecological risk measurement with meaningful community consultation (World Bank, 1994; Suter, 1997). Health impact assessment (HIA) is a method for describing and estimating the effects that a proposed project or policy may have on the health of a population (British Columbia Ministry of Health, 1995; Ratner et al., 1997; British Medical Association, 1998). Like health itself,

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<sup>18</sup> In 1992, leaders of 120 nations and Non-Governmental Organisations assembled at the Earth Summit in Rio de Janeiro and signed a list of environmental pledges called Agenda 21. The United Nations General Assembly will held a special “Rio plus Ten” session next year in South Africa to check their progress. More information: <http://www.un.org/rio+10/flat/index.html>.



HIA is not value-neutral; the values used and the processes and outcomes they generate should be explicitly stated. Equity is a key value in health impact assessment, because public policy impacts disproportionately on the already disadvantaged. From the adoption of an equity focused approach follow the need for participatory methods and for openness of all stages of the evaluation process to public scrutiny (Scottt-Samuel, 1998).

An even more interesting development is that of a principle for new policies advocated by scientists internationally. This is the precautionary principle (PP). The PP has been defined as *“when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically”* (Montague, 1998). The PP has been developed by scientists in the face of scientific uncertainty. It is a strong call for prevention of potential harm and caution in action. We must act on facts, and on the most accurate interpretation of them, using the best scientific information. That does not mean that we must sit back until we have 100% evidence about everything. The Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21, states<sup>19</sup>:

*“In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”*

Raffensperger and Tickner (1999) have argued that where the state of the health of the people is at stake, the risks can be so high and the costs of corrective action so great, that prevention

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<sup>19</sup> For more information: <http://www.unep.org> and <http://www.ciesin.org/datasets/unced/unced.html>.



is better than cure. The possible benefits and costs of action and inaction must be analysed. Where there are significant risks of damage to the public health, we should be prepared to take action to diminish those risks, even when the scientific knowledge is not conclusive, if the balance of likely costs and benefits justifies it.

The PP is now embedded in numerous international treaties and conventions and has been enacted into law by several European countries (Montague, 1999). The principle is currently playing a strong role in public debates about the future of genetically engineered foods, nuclear power, synthetic chemicals, wireless communications devices, and greenhouse gases implicated in global climate change (Graham, 1999). The precautionary principle is a fundamental principle of environmental health policy and provides explicit guidance to decision-making. In practice, implementation of this principle depends on operational “reasonableness”, especially when powerful groups have vested interests in not acknowledging the possibility of harm (Baum, 1998).

Finally, increasingly around the world, people who have ended up with the most hazardous and polluting industries in their local environments are protesting and mobilising. Thousands of grassroots movements claiming “environmental justice” have emerged around the world. The “environmental justice movement”, originated in the USA, is developing in Europe and internationally (Coleman, 1994). The US Environmental Protection Agency defines Environmental Justice thus<sup>20</sup>: *“the fair treatment and meaningful involvement of all people, regardless of race, ethnicity, income, national origin or educational level with respect to the development, implementation and enforcement of environmental laws, regulation and*

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<sup>20</sup> <http://www.epa.gov/region5/air/ej/fact.htm>.



*policies.”*

Fair treatment means that no population, due to policy or economic disempowerment, is forced to bear a disproportionate burden of the negative human health or environmental impact of pollution or other environmental consequences resulting from industrial, municipal and commercial operations or the execution of government programs and policies.

In many areas, those grassroots environmental movements that are oriented towards social justice are also beginning to form alliances and networks, thereby bringing the struggle to the next level and conscientising their members on the underlying root causes of their problems. In South Africa, for example, the Environmental Justice Networking Forum, formed in the early 1990s, now has more than 400 member groups and organisations. Through such networks, the struggle can be directed towards the goal of “not-in-anyone’s backyard”, this shifting attention to the deeper, more long-term problems of our societies’ power structures, lifestyles and injustices (Hallstrom, 2000).

## **10.2. IMPLICATIONS OF THE STUDY**

Oil industry argues that has a role to play in the development of the country and in the protection of environment and people they come in contact with through their operations (Texaco, 2001a, Shell, 2001, British Petroleum, 2001, Oxy, 2001). The case presented in this thesis shows a different picture. The Amazon region has the worst infrastructure and the lowest socio-economic and health indicators of the country (Terán, 2000). In addition, socio-economic conditions in the country have not improved with the oil development (see appendix 2).



The study supported the hypothesis presented by *FDA*. Water used for drinking, washing and bathing by the residents living near oil fields showed a high concentration of TPH, at a level high enough to cause alarm. The study suggested a higher risk of adverse effects such as reported skin mycosis, tiredness, itchy nose, sore throat, headache, red eyes, ear pain, diarrhoea and gastritis among women living near oil fields. Symptoms significantly associated with exposure after adjustment were those expected from known toxicological effects of oil. An increased risk of spontaneous abortions among women living in the proximity of oil fields was shown. The study also investigated the incidence and mortality of cancer in a village located in an oil producing area of the Amazon basin of Ecuador. The study suggested an excess of cancers among the male population in the village. Results of overall cancer mortality were also higher than expected among males.

In the light of the results and above discussion the following recommendations are made:

- Further research is necessary in order to confirm these results in other communities experiencing similar exposures. A surveillance system to gain knowledge of the evolution of cancer incidence and distribution in the area is also recommended. Academic institutions have a role to play together with local organisations and communities to further investigate the effect of oil contaminants on health and the risk of cancer. There is also a need for studies to clarify the overall implications of this form of development for local health, particularly for women.
- Local organisations, such as *FDA*, should continue their work with communities to secure their rights to live in a clean environment. In the long term, a commitment of the Ecuadorian government to develop mechanisms to enforce the laws protecting the



environment and the health of their citizens is a challenge. This should be addressed in the context of the need to promote human rights, combat corruption and strengthen democratic institutions. The new Constitution of Ecuador acknowledges the right of communities to be consulted by oil companies before starting the exploratory stage. Community organisations collaborating with regional, national and international environmental groups are essential in the enforcement of these rights.

- The Ecuadorian government should conduct an evaluation of the environmental situation in the region and to develop and oversee the implementation of a plan to repair the damage and limit further destruction. While oil pollution persists, the health of this and other similar population will remain at risk. Some indigenous and environmental groups have called for the application of the precautionary principle (see section 10.1.1) and asked the government for a moratorium on oil and gas development in new areas of the Amazon (Centro de Derechos Económicos y Sociales, 2000b).
- In the short term, oil companies operating in the Amazon of Ecuador should change their practices to minimise environmental impact and build partnerships with local communities to bring them benefits from development. Environmental protection standards should be available to local communities and independent environmental groups. An environmental monitoring system should be established with the involvement of the affected communities.
- While Ecuador requires oil companies to provide environmental impacts assessment to state environmental agencies, those agencies are not obliged to make their statements public. Without such basic information, people are left ignorant of potential risks and



cannot participate meaningfully in public policy or hold companies accountable for their actions. Oil development policies have an impact on health and their consequences need to be assessed and taken into account. The Ecuadorian government should acknowledge the need for health impact assessments as an integral feature of policy development and evaluation (see section 10.1.1). Both, environmental and health impact assessment require a meaningful community consultation and participation to ensure that development promotes rather than endangers health.

### **10.3. HAS POPULAR EPIDEMIOLOGY A ROLE TO PLAY IN A GLOBAL SCENARIO?**

Humanity will face the enormity of the ecology crisis in the twenty-first century (Beaglehole and Bonita, 1997; Baum, 1998). While some details of this crisis are still disputed among experts, there is increasing agreement that the world's natural systems are out of balance and that the effects of this will have an enormous impact on health (McMichael, 1995; Boyden, 1996). Often decisions about development and the environment appear to be driven by the notion that there are no limits to growth and that one day we will entirely conquer death and disease. Yet the public health task is more to do with providing environments in which all people can lead healthy lives and then die with dignity in reasonable living environment without destroying the planet on which all health depends (Baum, 1998).

Wing (1998) has noted that *“to transform society in support of more fundamental health promotion and social justice, a different approach to scientific study is necessary”*. This approach should include: i) an ecologic component where the scientific perspective must explicitly analyse the historical organisation of the systems under study, including human society, and place of the study of specific exposure with this context and, ii) a democratic



component, where the perspectives and interests of most people, not just those who control the economic, academic and information institutions must be recognised and included, and that education between scientists and the public must take place in both directions.

These sentiments are compatible with those of popular epidemiology's emphasis on community empowerment and control. The potential for creating an epidemiological analysis, based on popular struggles - one which suggests alternative policy solutions - can be illustrated by the popular epidemiology approach: lay people working with professionally trained scientists in a community-driven process where the value of research would depend on its ability to help answer questions about local concerns and to present local concerns in a political forum where legislation and regulation could be used to increase local control over industry or other threats, reduce their impact and encourage healthier economic development.

There are clear implications for changes to be made at multiple level (e.g. individual training, institutional reward structures), within and across the organisations involved (e.g. university, government agency, community-based organisation, funding institution) to foster and strengthen popular epidemiology within public health (Green et al., 1994).

The advantages of popular epidemiology lie in health education and promotion simultaneously developing alongside the research, empowerment of communities, scientists and citizens working together and the possibility of greater public credibility for epidemiological studies done along these lines (Watterson, 1994; Baum, 1998; Arcury et al., 2000). Popular epidemiology is particularly aimed toward working with marginalized communities, whose members experience limited access to resources and decision-making



processes. The emphasis is on integrating the generation of knowledge into strategies to provide community and social change (Israel et al., 1998).

Popular epidemiology is a challenge for every researcher claiming to be working in the interest of community health, especially so in developing countries. The time of globalisation with its characteristics of growing uncontrolled multinationals is also a time where communication and information easily travel around the world. This increases the possibilities for links to be made between local and international researchers. The meeting of communities and researchers in a point of understanding and common interest will result in exploration of new grounds and contribution to communities' health.

Popular epidemiology is an essential approach for public health researchers to reaffirm their roots in improving public health as a primary value. The long-term commitment and combined efforts and expertise of all the partners involved can expand and refine the process, thus contributing to the health and well-being of the communities and institutions involved.



## REFERENCES

- Abbey DE, Nishino N, McDonnell WF, Burchette RJ, Knutsen SF, Lawrence-Beeson W, Yang JX. (1999). Long-term inhalable particles and other air pollutants related to mortality in nonsmokers. *American Journal of Respiratory and Critical Care Medicine*, 159 (2): 373-382.
- Acheson D. (1998). Report of independent inquiry into inequalities in health. London: Stationery Office.
- Acosta A. (2000). El petróleo en el Ecuador: una evaluación crítica del pasado cuarto de siglo. In: Martínez E (ed.) *El Ecuador post petrolero*. Quito: Acción Ecológica.
- Al Yakoob SN, Gundersen D, Curtis L. (1996). Effects of the water-soluble fraction of partially combusted crude oil from Kuwait's oil fires (from Desert Storm) on survival and growth of the marine fish *Menidia beryllina*. *Ecotoxicology and Environmental Safety*, 35 (2): 142-149.
- Almeida A. (2000). Reseña sobre la historia ecológica de la Amazonía ecuatoriana. In: Martínez E (ed.) *El Ecuador post petrolero*. Quito: Acción Ecológica.
- Alston D and Brown N. (1993). Global threats to people of color. In: Bullard RD and Chavis BF (eds.) *Confronting environmental racism, voices from the grassroots*. Boston: South End Press.
- Althaus D. (1996). Amazon's empty legacy; big oil responds to environment: toll on rain forest, culture still unacceptable to crisis. *The Houston Chronicle*, December 15.
- Amunárriz M. (1991). Estudios sobre patologías tropicales en la Amazonía ecuatoriana. Pompeya, Ecuador: Cicame.
- Andrade J. (1998). Ley y petróleo: 26 años de legislación. In: Cetape-Fetrapec (ed.) *Petróleo y sociedad*, volumen 8. Quito: Cetape-Fetrapec.
- Arauz LA. (1999). Visión histórica petrolera ecuatoriana: síntesis de 1972 a 1998. Quito: Universitaria.
- Arbuckle TE, Savitz DA, Mery LS, Curtis KM. (1999). Exposure to phenoxy herbicides and the risk of spontaneous abortion. *Epidemiology*, 10 (6): 752-760.
- Arcury TA, Austin CK, Quandt SA, Saavedra R. (1999). Enhancing community participation in intervention research: farmworkers and agricultural chemicals in North Carolina. *Health Education & Behavior*, 26 (4): 563-578.
- Arcury TA, Quandt SA, McCauley L. (2000). Farmworkers and pesticides: community-based research. *Environmental Health Perspectives*, 108 (8): 787-792.



- Attias L, Bucchi AR, Maranghi G, Holt S, Marcello I, Zapponi GA. (1995). Crude oil spill in sea water: an assessment of the risk for bathers correlated to benzo(a)pyrene exposure. *Centro European Journal of Public Health*, 3 (3): 142-145.
- Atwood K, Colditz GA, Kawachi I. (1997). From public health science to prevention policy: placing science in its social and political contexts. *American Journal of Public Health*, 87 (10): 1603-1606.
- Austin H, Delzell E, Cole P. (1988). Benzene and leukemia. A review of the literature and a risk assessment. *American Journal of Epidemiology*, 127 (3): 419-439.
- Axelsson G and Molin I. (1988). Outcome of pregnancy among women living near petrochemical industries in Sweden. *International Journal of Epidemiology*, 17 (2): 363-369.
- Axelsson G and Rylander R. (1989). Outcome of pregnancy in women engaged in laboratory work at a petrochemical plant. *American Journal of Industrial Medicine*, 16 (5): 539-545.
- Banner RO, DeCambra H, Enos R, Gotay C, Hammond OW, Hedlund N, Issell BF, Matsunaga DS, Tsark JA. (1995). A breast and cervical cancer project in a native Hawaiian community: Wai'anae cancer research project. *Preventive Medicine*, 24 (5): 447-453.
- Bates DV and Sizto R. (1989). The Ontario air pollution study: identification of the causative agent. *Environmental Health Perspectives*, 79: 69-72.
- Baum F. (1988). Community based research for the new public health. *Health Promotion*, 3 (3): 259-268.
- Baum F. (1995). Researching public health: behind the qualitative-quantitative methodological debate. *Social Science and Medicine*, 40 (4): 459-468.
- Baum F. (1998). *The new public health: an Australian perspective*. Melbourne: Oxford University Press.
- Beaglehole R and Bonita R. (1997). *Public health at the crossroads: achievements and prospects*. Cambridge: Cambridge University Press.
- Bello W. (1996). Structural adjustment programs: success for whom. In: Mander J and Goldsmith E (eds.) *The case against the global economy*. San Francisco: Sierra Club, pp 285-293.
- Berkman L and Kawachi I (eds.). (2000). *Social epidemiology*. Oxford: Oxford University Press.
- Bernard HR. (1988). *Research methods in cultural anthropology*. Newbury Park, CA: Sage.
- Bertazzi PA, Pesatori AC, Zochetti C, Latocca R. (1989). Mortality study of cancer risk among oil refinery workers. *International Archives of Occupational and Environmental Health*, 61 (4): 261-270.



- Bezruchka S. (2000). Is globalization dangerous to our health?. *Western Journal of Medicine*, 172: 332-334.
- Blot WJ, Brinton LA, Fraumeni JF, Stone BJ. (1977). Cancer mortality in U.S. counties with petroleum industries. *Science*, 198 (4312): 51-53.
- Blowers A. (1993). Master of fate or victim of circumstance: the exercise of corporate power in environmental policy-making. In: Hill M (ed.) *The policy process: a reader*. London: Harvester Wheatsheaf, pp 157-179.
- Boffetta P, Jourenkova N, Gustavsson P. (1997). Cancer risk from occupational and environmental exposure to polycyclic aromatic hydrocarbons. *Cancer Causes Control*, 8 (3): 444-472.
- Boischio AA and Henshel DS. (1996). Risk assessment of mercury exposure through fish consumption by the riverside people in the Madeira Basin, Amazon, 1991. *Neurotoxicology*, 17 (1): 169-175.
- Boletín de la Red de Monitoreo. (1997). Boletín número 1. Lago Agrio, Ecuador: Red de Monitoreo Ambiental.
- Bonassi S, Merlo F, Pearce N, Puntoni R. (1989). Bladder cancer and occupational exposure to polycyclic aromatic hydrocarbons. *International Journal of Cancer*, 44 (4): 648-651.
- Boonchalaksi W. (1993). The reliability and validity of qualitative research methods. In: Yoddumnern-Attig B, Allen-Attig G, Boonchalaksi W, Richter K, Soonthorndhada A (eds.) *Qualitative methods for population and health research*. Thailand: Institute for Population and Social Research, Mahidol University.
- Boone MS. (1989). *Capital crime: black infant mortality in America*. Newbury Park, CA: Sage.
- Boyden S. (1996). Humans and the health of the biosphere. In: Bryan Furnass JW and Harris J (eds.) *Survival – Health and well-being*. Canberra: Nature and Society Forum.
- Brannen J. (1992). Combining qualitative and quantitative approaches: an overview. In: Brannen J (ed.) *Mixing methods: qualitative and quantitative research*. Avebury, UK: Ashgate Publishing Limited.
- Bremner SA, Anderson HR, Atkinson RW, McMichael AJ, Strachan DP, Bland JM, Bower JS. (1999). Short-term associations between outdoor air pollution and mortality in London 1992-4. *Occupational and Environmental Medicine*, 56 (4): 237-244.
- Briggs KT, Yoshida SH, Gershwin ME. (1996). The influence of petrochemicals and stress on the immune system of seabirds. *Regulatory and Toxicology Pharmacology*, 23 (2): 145-155.
- British Columbia Ministry of Health. (1995). *Health impact assessment guidelines*. Report 945. Victoria BC: BC Ministry of Health and Ministry Responsible for Seniors.



- British Medical Association. (1998). Health and environmental impact assessment: an integrated approach. London: Earthscan.
- British Petroleum. (2001). <http://www.bp.com/alive/>.
- Bromley RJ. (1977). Development Planning in Ecuador. Sussex: Hove.
- Brown LD. (1983). Organizing participatory research: interfaces for joint inquiry and organizational change. *Journal of Occupational Behaviour*, 4: 9-19.
- Brown P. (1987). Popular epidemiology: community response to toxic waste -induced disease in Woburn, Massachusetts. *Science, Technology and Human Values*, 12 (3-4): 78-85.
- Brown P. (1992). Popular epidemiology and toxic waste contamination: lay and professional ways of knowing. *Journal of Health and Social Behaviour*, 33 (3): 267-281.
- Buchanan DR. (1996). Building academic-community linkages for health promotion: a case study in Massachusetts. *American Journal of Health Promotion*, 10 (4): 262-269.
- Cabodevilla MA. (1997). Coca: la región y sus historias. Pompeya, Ecuador: Cicame.
- Cairncross S and Kochar V. (1994). Studying hygiene behaviour: methods, issues and experiences. New Delhi: Sage.
- Campbell D, Cox D, Crum J, Foster K, Christie P. (1993). Initial effects of the grounding of the tanker Braer on health in Shetland. *British Medical Journal*, 307 (6914): 1251-1255.
- Campbell D, Cox D, Crum J, Foster K, Riley A. (1994). Later effects of grounding of tanker Braer on health in Shetland. *British Medical Journal*, 309 (6957): 773-774.
- Carey JW. (1993). Linking qualitative and quantitative methods: integrating cultural factors into public health. *Qualitative Health Research*, 3: 298-318.
- Centers for Disease Control. (1990). Guidelines for investigating cluster of health events. *MMWR*, 39: 1-23.
- Centro de Derechos Económicos y Sociales. (1994). Violaciones de derechos en la Amazonía Ecuatoriana. Quito: Abya-Yala.
- Centro de Derechos Económicos y Sociales. (2000a). Apertura 2000 ... La solución al país? Boletín número 2, Marzo. Quito: Centro de Derechos Económicos y Sociales.
- Centro de Derechos Económicos y Sociales. (2000b). Una opción para el país: deuda por conservación de la Amazonía. Quito: Centro de Derechos Económicos y Sociales.
- Chambers R. (1997). Whose reality counts? Putting the first last. London: Intermediate Technology Publications.



- Chew FT, Goh DY, Ooi BC, Saharom R, Hui JK, Lee BW. (1999). Association of ambient air-pollution levels with acute asthma exacerbation among children in Singapore. *Allergy*, 54 (4): 320-329.
- Clark CR, Walter MK, Ferguson PW, Katchen M. (1988). Comparative dermal carcinogenesis of shale and petroleum-derived distillates. *Toxicology and Industrial Health*, 4 (1): 11-22.
- Coimbra CEA. (1988). Human factors in the epidemiology of malaria in the Brazilian Amazon. *Human Organization*, 47 (3): 254-260.
- Colditz GA. (1997). Epidemiology – future directions. *International Journal of Epidemiology*, 26 (4): 693-697.
- Coleman DA. (1994). *Ecopolitics: building a green society*. New Brunswick, NJ: Rutgers University Press.
- Collingwood KW, Raabe GK, Wong O. (1996). An updated cohort mortality study of workers at a northeastern United States petroleum refinery. *International Archives of Occupational and Environmental Health*, 68 (5): 277-288.
- Confederación de Nacionalidades Indígenas de la Amazonía Ecuatoriana. (1985). *Palma africana y etnocidio*. Quito: Centro de Estudios y Difusión Social.
- Connelly J. (1994). Social science provides a framework for epidemiology. *British Medical Journal*, 308 (6935): 1569.
- Cooper SP, Labarthe D, Downs T, Burau K, Whitehead L, Vernon S, Spitz M, New B, Sigurdson A. (1997). Cancer mortality among petroleum refinery and chemical manufacturing workers in Texas. *Journal of Environmental Pathology, Toxicology and Oncology*, 16 (1): 1-14.
- Coppock RW, Mostrom MS, Stair EL, Semalulu SS. (1996). Toxicopathology of oilfield poisoning in cattle: a review. *Veterinary and Human Toxicology*, 38 (1): 36-42.
- Cornwall A. (1996). Towards participatory practice: participatory rural appraisal and the participatory process. In: De Koning K and Martin M (eds.) *Participatory research in health: issues and experiences*. London: Zed Books, pp 94-107.
- Cornwall A and Jewkes R. (1995). What is participatory research?. *Social Science and Medicine*, 41 (12): 1667-1676.
- Correa A, Gray RH, Cohen R, Rothman N, Shah F, Seacat H, Corn M. (1996). Ethylene glycol ethers and risks of spontaneous abortion and subfertility. *American Journal of Epidemiology*, 143 (7): 707-717.
- Coughlin SS. (1996). Environmental justice: the role of epidemiology in protecting unempowered communities from environmental hazards. *The Science of the Total Environment*, 184 (1-2): 67-76.



Coura JR, Junqueira AC, Giordano CM, Funatsu RK. (1994). Chagas' disease in the Brazilian Amazon: I. A short review. *Revista do Instituto do Medicina Tropical do Sao Paulo*, 36 (4): 363-368.

Couto RA. (1986). Failing health and new prescriptions: community based approaches to environmental risks. In: Hill CE (ed.) *Current health policy issues and alternatives: an applied social science perspective*. Athens: University of Georgia Press.

Dagg TG, Satin KP, Bailey WJ, Wong O, Harmon LL, Swencicki RE. (1992). An updated cause specific mortality study of petroleum refinery workers. *British Journal of Industrial Medicine*, 49 (3): 203-212.

Daniel M, Green LW, Marion SA, Gamble D, Herbert CP, Hertzman C, Sheps SB. (1999). Effectiveness of community-directed diabetes prevention and control in a rural Aboriginal population in British Columbia, Canada. *Social Science and Medicine*, 48 (6): 815-832.

De Koning K and Martin M (eds.). (1996). *Participatory research in health: issues and experiences*. London: Zed Books.

De Laine MD. (1997). *Ethnography: theory and application in health research*. Sydney: MacLennan & Petty.

De Leeuw E. (1993). Health policy, epidemiology and power: the interest web. *Health Promotion International*, 8 (1): 49-52.

Deloraine A, Zmirou D, Tillier C, Boucharlat A, Bouti H. (1995). Case-control assessment of the short-term health effects of an industrial toxic waste landfill. *Environmental Research*, 68 (2): 124-132.

Department of Health. (1998). *Our healthier nation*. London: Stationery Office.

Diabetes Prevention Program Research Group. (1999). The Diabetes Prevention Program: design and methods for a clinical trial in the prevention of type 2 diabetes. *Diabetes Care*, 22 (4): 623-634.

Diaz M and Simmons R. (1999). When is research participatory? Reflections on a reproductive health project in Brazil. *Journal of Women's Health*, 8 (2): 175-184.

Dirección General de Medio Ambiente. (1989). *Estudio de impacto ambiental 42*. Quito: Dirección General de Medio Ambiente.

Divine BJ, Barron V, Kaplan SD. (1985). Texaco mortality study I. Mortality among refinery, petrochemical and research workers. *Journal of Occupational Medicine*, 27 (6): 445-447.

Divine BJ and Barron V. (1987). Texaco mortality study III. A cohort study of producing and pipeline workers. *American Journal of Industrial Medicine*, 11 (2): 189-202.

Divine BJ and Hartman CM. (2000). Update of a study of crude oil production workers 1946-94. *Occupational and Environmental Medicine*, 57 (6): 411-417.



- Doll R and Hill AB. (1964). Mortality in relation to smoking: ten years' observations of British doctors. *British Medical Journal* II: 1399-1410, 1460-1467.
- Doyle P, Roman E, Beral V, Brookes M. (1997). Spontaneous abortion in dry cleaning workers potentially exposed to perchloroethylene. *Occupational and Environmental Medicine*, 54 (12): 848-853.
- Dressler WW. (1993). Commentary on Community research: partnership in black communities. *American Journal of Preventive Medicine*, 9 (suppl.): S32-S34.
- Drijver M and Woudenberg F. (1999). Cluster management and the role of concerned communities and the media. *European Journal of Epidemiology*, 15 (9): 863-869.
- Duffy LK, Bowyer RT, Testa JW, Faro JB. (1993). Differences in blood haptoglobin and length-mass relationships in river otters (*Lutra canadensis*) from oiled and nonoiled areas of Prince William Sound, Alaska. *Journal of Wildlife Diseases*, 29 (2): 353-359.
- Editorial. (1999). The future of epidemiology. *Epidemiologic Monitor*, 21: 1-28.
- Edwards WC. (1989). Toxicology of oil field wastes. Hazards to livestock associated with the petroleum industry. *Veterinary and Clinical North American Food and Animal Practice*, 5 (2): 363-374.
- Eisenberg L. (1984). Rudolf Ludwig Karl Virchow, where are you now that we need you?. *American Journal of Medicine*, 77 (3): 524-532.
- El Comercio. (1999a). Los indígenas bloquean a la Arco. Quito, December 10.
- El Comercio. (1999b). Epidemia de hepatitis entre los huao. Quito, March 14.
- El Comercio. (2000). El crudo nacional tiene cuatro nuevos extractores. Quito, February 14.
- Energy Information Administration. (1997). <http://www.eia.doe.gov/emeu/cabs/ecuador.html>. United States of America, December.
- Energy Information Administration. (2001). <http://www.eia.doe.gov/emeu/cabs/ecuador.html>. United States of America, January.
- Eng E and Parker EA. (1994). Measuring community competence in the Mississippi Delta: the interface between program evaluation and empowerment. *Health Education Quarterly*, 21: 199-220.
- Entwistle VA, Renfrew MJ, Yearley S, Forrester J, Lamont T. (1998). Lay perspectives: advantages for health research. *British Medical Journal*, 316 (7129): 463-466.
- Everall JD and Dowd PM. (1978). Influence of environmental factors excluding ultra violet radiation on the incidence of skin cancer. *Bulletin of Cancer*, 65 (3): 241-247.
- Ezenwa AO. (1996). Studies of risks associated with technological development in Nigeria. *Journal of the Royal Society of Health*, 116 (6): 376-380.



Fabra A. (1998). Indigenous peoples, environmental degradation and human rights: a case study. In: Boyle A and Anderson M (eds.) Human rights approaches to environmental protection. Oxford: Claredon Press, pp 245-264.

Fagin D and Lavelle M. (1996). Toxic deception: how the chemical industry manipulates science, bends the law, and endangers your health. Secaucus, NJ: Carol Publishing Group.

Fagliano J, Berry M, Bove F, Burke T. (1990). Drinking water contamination and the incidence of leukaemia: an ecologic study. *American Journal of Public Health*, 80 (10): 1209-1212.

Feuerstein MT. (1986). Partners in evaluation: evaluating development and community programmes with participants. London: Macmillan.

Feuston MH, Mackerer CR, Schreiner CA, Hamilton CE. (1997). Systemic toxicity of dermally applied crude oils in rats. *Journal of Toxicology and Environmental Health*, 51 (4): 387-399.

Finger M and Kilcoyne J. (1997). Why transnational corporations are organizing to "save the global environment". *The Ecologist*, 27 (4): 138-142.

Finkelstein MM. (1996). Asbestos associated cancers in the Ontario refinery and petrochemical sector. *American Journal of Industrial Medicine*, 30 (5): 601-615.

Fitzgerald E. (1998). The development implications of the Multilateral Agreement on Investment. Unpublished report prepared by the Finance and trade policy research centre, University of Oxford for the United Kingdom Department for International Development. Oxford: University of Oxford.

Foucault M. (1973). The birth of the clinic: an archaeology of medical perception. New York: Pantheon.

Foucault M. (1979). Discipline and punish. The birth of the prison. London: Penguin.

Freire P. (1972). Pedagogy of the oppressed. Harmondsworth: Penguin.

French HF. (2000). Vanishing borders: protecting the planet in the age of globalization. Washington DC: Worldwatch Institute.

Frente de Defensa de la Amazonía. (1999). La Texacontaminación en el Ecuador. Lago Agrio, Ecuador: Frente de Defensa de la Amazonía.

Frerichs RR, Becht JN, Foxman B. (1980). A household survey of health and illness in rural Bolivia. *Bulletin of the Pan American Health Organization*, 14 (4): 343-355.

Freudenberg N. (1984). Citizen action for environmental health: report on a survey of community organizations. *American Journal of Public Health*, 74 (5): 444-448.

Fundación José Peralta. (1999). Ecuador: su realidad. Quito: Fundación de Investigación y Promoción Social José Peralta.



- Fundación Natura. (1996). La actividad petrolera en el Ecuador: aspectos ambientales y sociales. Quito: Fundación Natura.
- Galarza J. (1972). El festín del petróleo. Cuenca, Ecuador: Sol.
- Gamble JP, Pearlman ED, Nicolich MJ. (1996). A nested case-control study of kidney cancer among refinery/petrochemical workers. *Environmental Health Perspectives*, 104 (6): 642-650.
- Garro LC. (1990). Explaining high blood pressure: variation in knowledge about illness. *American Ethnologist*, 15: 98-119.
- Garzón P. (1995). Impacto socioambiental de la actividad petrolera: estudio de caso de las comunidades San Carlos y La Primavera. In: Varea A and Ortiz P (eds.) *Marea negra en la Amazonía: conflictos socioambientales vinculados a la actividad petrolera en el Ecuador*. Quito: Abya-Yala, pp 265-294.
- Gaventa J. (1988). Participatory research in North America. *Convergence*, 21: 17-46.
- Gerin M, Siemiatycki J, Desy M, Krewski D. (1998). Associations between several sites of cancer and occupational exposure to benzene, toluene, xylene, and styrene: results of a case-control study in Montreal. *American Journal of Industrial Medicine*, 34 (2): 144-156.
- Goldman BA. (1992). Equity and the 1992 Rio Earth Summit. *Fordham Environmental Law Report*, 4 (1): 1-8.
- Goldstein DH and Bendit JN. (1970). An epidemiological study of an oil mist exposure. *Archives of Environmental Health*, 21: 600-603.
- González G, Gálvez AM, Jaramillo M. (1988). Factores socioeconómicos y mortalidad infantil en Ecuador 1970-1981. *Revista do Saúde Publica*, 22: 273-280.
- Gorman RW, Berardinelli SP, Bender TR. (1991). Health hazard evaluation report HETA 89-200 and 89-273-2111, Exxon Valdez Alaska oil spill. Cincinnati: Cincinnati Hazard Evaluation and Technical Assistance Branch, NIOSH, US Department of Health and Human Services.
- Gottlieb MS, Shear CL, Seale DB. (1982). Lung cancer mortality and residential proximity to industry. *Environmental Health Perspectives*, 45: 157-164.
- Graber DR and Aldrich TE. (1993). Community organizations and potential disease cluster evaluation. *Social Science and Medicine*, 37 (8): 1079-1085.
- Graham JD. (1999). Making sense of the precautionary principle. *Risk in Perspective*, 7 (6): 1-6.
- Green LW, George MA, Daniel M, Frankish CJ, Herbert CJ, Bowie WR. (1994). Study of participatory research in health promotion. Ottawa: Royal Society of Canada.
- Greer J and Bruno K. (1996). *Greenwash: the reality behind corporate environmentalism*. Kuala Lumpur: Third World Network and APEX Press.



Greer J and Singh K. (2001). A brief history of TNCs. <http://www.igc.org/trac/corner/glob/history/>.

Griffith J, Aldrich T, Drane W. (1993). Risk assessment. In: Aldrich T, Griffith J, Cooke C (eds.) *Environmental epidemiology and risk assessment*. New York: Van Nostrand Reinhold, pp 212-239.

Hall AJ, Watkins J, Hiby L. (1996). The impact of the 1993 Braer oil spill on grey seals in Shetland. *The Science and Total Environment*, 186 (1-2): 119-125.

Hallstrom N. (2000). The environmental crisis: threats to health and ways forward. Working paper presented at the People's Health Assembly. Bangladesh, December. <http://www.pha2000.org/analytical.htm>.

Hanratty DM. (1989). Ecuador: a country study. Federal Research Division, US Library of Congress. <http://lcweb2.loc.gov/frd/cs/ectoc.html>.

Harrington JM. (1987). Health experience of workers in the petroleum manufacturing and distribution industry: a review of the literature. *American Journal of Industrial Medicine*, 12 (5): 475-497.

Hatch J, Moss N, Saran A, Presley-Cantrell L, Mallory C. (1993). Community research: partnership in Black communities. *American Journal of Preventive Medicine*, 9 (suppl.): S27-S31.

Hayes RB, Yin SN, Dosemeci M, Li GL, Wacholder S, Travis LB, Li CY, Rothman N, Hoover RN, Linet MS. (1997). Benzene and the dose-related incidence of hematologic neoplasms in China. *Journal of the National Cancer Institute*, 89 (14): 1065-1071.

Hearey CD, Ury H, Siegelau A, Ho MK, Salomon H, Cella RL. (1980). Lack of association between cancer incidence and residence near petrochemical industry in the San Francisco Bay area. *Journal of the National Cancer Institute*, 64 (6): 1295-1299.

Hecker R. (1997). Participatory action research as a strategy for empowering Aboriginal health workers. *Australian and New Zealand Journal of Public Health*, 21 (7): 784-788.

Hellou J, Upshall C, Payne JF, Hodson PV. (1994). Polycyclic aromatic compounds in cod (*Gadus morhua*) from the Northwest Atlantic and St. Lawrence Estuary. *The Science and Total Environment*, 145 (1-2): 71-79.

Hemminki K, Niemi ML, Saloniemi I, Vainio H, Hemminki E. (1980). Spontaneous abortions by occupation and social class in Finland. *International Journal of Epidemiology*, 9 (2): 149-153.

Hennekens CH and Buring JE. (1987). *Epidemiology in medicine*. Boston: Little, Brown and Company.

Herbert CP. (1996). Community-based research as a tool for empowerment: the Haida Gwaii diabetes project example. *Canadian Journal of Public Health*, 87 (2): 109-112.



- Heredia C and Purcell M. (1996). Structural adjustment and the polarization of Mexican society. In: Mander J and Goldsmith E (eds.) *The case against the global economy*. San Francisco: Sierra Club, pp 273-284.
- Hewson D and Bennett A. (1987). Childbirth research data: medical records or women's reports?. *American Journal of Epidemiology*, 125 (3): 484-491.
- Hill AB. (1987). The environment and disease: association or causation. In: Rothman K (ed.) *Evolution of epidemiologic ideas*. Chestnut Hill, MA: Epidemiology Resources Inc.
- Hobcroft J. (1987). The proximate determinants of fertility. In: Cleland J and Scott C (eds.) *The World fertility survey: an assessment*. New York: Oxford University Press.
- Hoffman DJ. (1979). Embryotoxic and teratogenic effects of petroleum hydrocarbons in mallards (*Anas platyrhynchos*). *Journal of Toxicology and Environmental Health*, 5 (5): 835-844.
- Hong E. (2000). Globalisation and the impact on health: a third world view. Working paper prepared for The Peoples' Health Assembly. Bangladesh, December. <http://www.pha2000.org/analytical.htm>.
- Howze EN and Hughes JM. (1990). Elevated respirable dust levels along unpaved coal-haul roads: a rural public health problem. *American Review of Respiratory Diseases*, 141 (4): A77.
- Hu H and Kim NK. (1993). Drinking water pollution and human health. In: Chivian E, McCally M, Hu H, Haines A (eds.) *Critical condition, human health and the environment*. Massachusetts: The Massachusetts Institute of Technology.
- Hundt GA and Forman MR. (1993). Interfacing anthropology and epidemiology: the Bedouin Arab infant feeding study. *Social Science and Medicine*, 36 (7): 957-964.
- Hunt CW. (1989). Migrant labour and sexually transmitted disease: AIDS in Africa. *Journal of Health and Social Behaviour*, 30 (4): 353-373.
- Institute of Medicine. (1988). *Future of Public Health*. Washington DC: National Academy Press, pp 1-7.
- Instituto Nacional de Estadísticas y Censos. (1995). *Cifrando y descifrando Napo*. Quito: Instituto Nacional de Estadísticas y Censos.
- International Agency for Research on Cancer. (1983). *IARC monographs on the evaluation of the carcinogenic risk of chemicals to man: polynuclear aromatic hydrocarbons*. Volume 34. Lyon: International Agency for Research on Cancer.
- International Agency for Research on Cancer. (1987). *Overall evaluation of carcinogenicity: an updating of IARC Monograph Volumes 1 to 42*. IARC monographs on the evaluation of the carcinogenic risk of chemicals to human, suppl. 7. Lyon: International Agency for Research on Cancer.



International Agency for Research on Cancer. (1989). IARC monographs on the evaluation of the carcinogenic risk of chemicals to man: occupational exposures to petroleum refining; crude oil and major petroleum fuels. Volume 45. Lyon: International Agency for Research on Cancer.

International Labour Office. (1986). Psychosocial factors at work: recognition and control. Occupational safety and health series, volume 56. Geneva: International Labour Office.

Israel BA, Schurman SJ, Hugentobler MK. (1992). Conducting action research: relationships between organization members and researchers. *Journal of Applied Behavior Science*, 28: 74-101.

Israel BA, Schulz AJ, Parker EA, Becker AB. (1998). Review of community-based research: assessing partnership approaches to improve public health. *Annual Review of Public Health*, 19: 173-202.

Jenkins C and Howard P. (1992). The use of ethnography and structures observations in the study of risk factors for the transmission of diarrhoea in high land Papua New Guinea. *Medical Anthropology*, 15 (1): 1-16.

Jenssen BM. (1996). An overview of exposure to, and effects of, petroleum oil and organochlorine pollution in grey seals (*Halichoerus grypus*). *The Science and Total Environment*, 186 (1-2): 109-118.

Jewkes R and Murcott A. (1998). Community representatives: representing the community?. *Social Science and Medicine*, 46 (7): 843-858.

Jochnick C, Normand R, Zaidi S. (1994). Rights violations in the Ecuadorian Amazon: the human consequences of oil development. *Health and Human Rights*, 1 (1): 82-100.

Jochnick C. (1995). Amazon oil offensive. *Multinational Monitor*, Vol XVI, No. 1-2.

Jukofsky D. (1991). Oil and rainforest mix. *American Forestry*, 97: 48.

Kaldor J, Harris JA, Glazer E, Glaser S, Neutra R, Mayberry R, Nelson V, Robinson L, Reed D. (1984). Statistical association between cancer incidence and major-cause mortality, and estimated residential exposure to air emissions from petroleum and chemical plants. *Environmental Health Perspectives*, 54: 319-332.

Kaplan MB, Brandt-Rauf P, Axley JW, Shen TT, Sewell GH. (1993). Residential release of number 2 fuel oil: a contributor to indoor air pollution. *American Journal of Public Health*, 83 (1): 84-88.

Karliner J. (1997). *The corporate planet: ecology and politics in the age of globalization*. San Francisco: Sierra Club Books.

Karliner J. (1999). Co-opting the UN. *The Ecologist*, 29 (5): 318-321.

Kemmis S and McTaggart R. (1988). *The action research planner*. Melbourne: Deakin University.



- Khalil AM. (1995). Chromosome aberration in blood lymphocytes from petroleum refinery workers. *Archives of Environmental Contamination and Toxicology*, 28 (2): 236-239.
- Khan S, Payne F, Rahimtula AD. (1986). Mechanisms of petroleum hydrocarbon toxicity: functional changes in rat liver mitochondria after exposure to a Prudhoe Bay Crude Oil. *Toxicology Letters*, 32 (1-2): 141-146.
- Khan S, Irfan M, Rahimtula AD. (1987). The hepatotoxic potential of a Prudhoe Bay crude oil: effect on mouse liver weight and composition. *Toxicology*, 46 (1): 95-105.
- Khor M. (1997). Effects of globalisation on sustainable development after UNCED. *Third World Resurgence* No. 81/82.
- Kido T, Nogawa K, Honda R, Tsuritani I, Ishizaki M, Yamada Y, Nakagawa H. (1990). The association between renal dysfunction and osteopenia in environmental cadmium-exposed subjects. *Environmental Research*, 51 (1): 71-82.
- Kilburn KH and Warshaw RH. (1995). Neurotoxic effects from residential exposure to chemicals from an oil reprocessing facility and superfund site. *Neurotoxicology and Teratology*, 17 (2): 89-102.
- Kimerling J. (1991). *Amazon crude*. New York: Brickfront Graphics Inc.
- Kimerling J. (1995). Rights, responsibilities, and realities: environmental protection law in Ecuador's Amazon oil fields. *Southwestern Journal of Law and Trade in the Americas*, 2 (2): 293-384.
- Kimerling J. (1998). Oil development in Ecuador and Peru: Law, politics and the environment. Draft paper presented at Amazonia 2000: Development, environment and geopolitics. London: Institute of Latin American Studies, University of London.
- Kimerling J. (2000). La Texaco en el Ecuador: informe del juicio. In: Martínez E (ed.) *El Ecuador post petrolero*. Quito: Acción Ecológica.
- Kimerling J. (2001). Uncommon ground: Oxy's land access standards and practices in Quichua communities in the Ecuadorian Amazon. In: Kuppe R and Potz R (eds.) *Law & Anthropology: International Yearbook for Legal Anthropology*, volume 11. The Hague: Martinus Nijhoff Publishers (in press).
- Kline J, Stein Z, Susser M. (1989). *Conception to birth: epidemiology of prenatal development*. New York: Oxford University Press.
- Knox EG and Gilman EA. (1997). Hazard proximities of childhood cancers in Great Britain from 1953-80. *Journal of Epidemiology and Community Health*, 51 (2): 151-159.
- Knox Eg and Gilman EA. (1998). Migration patterns of children with cancer in Britain. *Journal of Epidemiology and Community Health*, 52 (11): 716-726.
- Kogevinas M. (1998). The loss of the population approach puts epidemiology at risk. *Journal of Epidemiology and Community Health*, 52 (10): 615-616.



- Koplan JP, Thacker SB, Lezin NA. (1999). Epidemiology in the 21<sup>st</sup> century: calculation, communication and intervention. *American Journal of Public Health*, 89 (8): 1153-1155.
- Korten D. (1995). *When corporations rule the world*. London: Earthscan.
- Krieger N. (1994). Epidemiology and the web of causation: has anyone seen the spider?. *Social Science and Medicine*, 39 (7): 887-903.
- Krieger N. (1999). Questioning epidemiology: objectivity, advocacy and socially responsible science. *American Journal of Public Health*, 89 (8): 1151-1152.
- Kroeger A. (1982). South American Indians between traditional and modern health services in rural Ecuador. *Bulletin of the Pan American Health Organization*, 16 (3): 242-254.
- Kunst A. (1997). *Cross-national comparisons of socio-economic differences in mortality*. Rotterdam: Department of Public Health. Erasmus University (Thesis).
- Lang TA and Secic M. (1997). *How to report statistics in medicine*. Philadelphia: American College of Physicians.
- Last JM (ed.). (1983). *A Dictionary of Epidemiology*. New York: Oxford University Press.
- Last JM (ed.). (1995). *A Dictionary of Epidemiology*. New York: Oxford University Press.
- Layder D. (1988). The relation of theory and method: causal relatedness, historical contingency and beyond. *Sociological Review*, 36: 441-463.
- Ledogar RJ, Acosta LG, Penchaszadeh A. (1999). Building international public health vision through local community research: the El Puente-CIET partnership. *American Journal of Public Health*, 89 (12): 1795-1797.
- Lee Y, O'Brien PJ, Payne JF, Rahimtula AD. (1986). Toxicity of petroleum crude oils and their effect on xenobiotic metabolizing enzyme activities in the chicken embryo in ovo. *Environmental Research*, 39 (1): 153-163.
- Leighton FA. (1986). Clinical, gross, and histological findings in herring gulls and Atlantic puffins that infested Prudhoe Bay crude oil. *Veterinary Pathology*, 23 (3): 254-263.
- Leon DA and Walt (eds.). (2000). *Poverty, inequality and health: an international perspective*. Oxford: Oxford University Press.
- Leviton LC, Marsh GM, Talbott E, Pavlock D, Callahan C. (1991). Drake chemical workers' health registry: coping with community tension over toxic exposures. *American Journal of Public Health*, 81 (6): 689-693.
- Lipscomb JA, Fenster L, Wensch M, Shusterman D, Swan S. (1991). Pregnancy outcomes in women potentially exposed to occupational solvents and women working in the electronics industry. *Journal of Occupational Medicine*, 33 (5): 597-605.



- Lockhart WL, Wagemann R, Tracey B, Sutherland D, Thomas DJ. (1992). Presence and implications of chemical contaminants in the freshwaters of the Canadian Arctic. *The Science and Total Environment*, 122 (1-2): 165-245.
- Loomis D, Castillejos M, Gold DR, McDonnell W, Borja-Aburto VH. (1999). Air pollution and infant mortality in Mexico City. *Epidemiology*, 10 (2): 118-123.
- Lyons RA, Monaghan SP, Heaven M, Littlepage BN, Vincent TJ, Draper GJ. (1995). Incidence of leukaemia and lymphoma in young people in the vicinity of the petrochemical plant at Baglan Bay, South Wales, 1974 to 1991. *Occupational and Environmental Medicine*, 52 (4): 225-228.
- Lyons RA, Temple MF, Evans D, Fone DL, Palmer SR. (1999). Acute health effects of the Sea Empress oil spill. *Journal of Epidemiology and Community Health*, 53 (5): 306-310.
- Macaulay AC, Delormier T, McComber AM, Cross EJ, Potvin LP, Paradis G, Kirby RL, Saad-Haddad C, Desrosiers S. (1998). Participatory research with native community of Kahnawake creates innovative code of research ethics. *Canadian Journal of Public Health*, 89 (2): 105-108.
- Macaulay AC, Commanda LE, Freeman WL, Gibson N, McGabe ML, Robbins CM, Twohig PL, for the North American Primary Care Research Group. (1999). Participatory research maximises community and lay involvement. *British Medical Journal*, 319 (7212): 774-778.
- Mackenbach JP. (1998). Multilevel ecoepidemiology and parsimony. *Journal of Epidemiology and Community Health*, 52 (10): 614-615.
- Mann RD. (1990). Africa on the brink: time running out. The urgent need for tree planting in Africa. *The Ecologist*, 20 (2): 48-53.
- Marmot M. (2000). Social determinants of health: from observation to policy. *Medical Journal of Australia*, 172 (8): 379-382.
- Marsh GM, Enterline PE, McCraw D. (1991). Mortality patterns among petroleum refinery and chemical plant workers. *American Journal of Industrial Medicine*, 19 (1): 29-42.
- Martínez E. (1995). Rechazo a la séptima ronda de licitaciones petroleras. In: Varea A and Ortiz P (eds.) *Marea negra en la Amazonía: conflictos socioambientales vinculados a la actividad petrolera en el Ecuador*. Quito: Abya-Yala, pp 181-218.
- Martínez E. (ed.). (2000). *El Ecuador post petrolero*. Quito: Acción Ecológica.
- Martz JD. (1987). *Politics and petroleum in Ecuador*. New Jersey: Transaction Books.
- Mastrangelo G, Fadda E, Marzia V. (1996). Polycyclic aromatic hydrocarbons and cancer in man. *Environmental Health Perspectives*, 104 (11): 1166-1170.
- Masterson-Allen S and Brown P. (1990). Public reactions to toxic waste contamination: analysis of a social movement. *International Journal of Health Services*, 20 (3): 485-500.



Matsunaga DS, Enos R, Gotay CC, Banner RO, DeCambra H, Hammond OW, Hedlund N, Ilaban EK, Issell BF, Tsark JA. (1996). Participatory research in a native Hawaiian community: The Wai'anae cancer research project. *Cancer*, 78 (7): 1582-1586.

McGreevy PB, Dietze R, Prata A, Hembree SC. (1989). Effects of immigration on the prevalence of malaria in rural areas of the Amazon basin of Brazil. *Memorias do Instituto Oswaldo Cruz*, 84 (4): 485-491.

McKee RH, Stubblefield WA, Lewis SC, Scala RA, Simon GS, DePass LR. (1986). Evaluation of the dermal carcinogenic potential of tar sands bitumen-derived liquids. *Fundamental and Applied Toxicology*, 7 (2): 228-235.

McKinlay JB. (1994). Towards appropriate levels of analysis, research methods and health public policy. Presented at the International Symposium on Quality of Life and Health: Theoretical and Methodological considerations. Berlin, May 25-27.

McKinlay JB and Marceau LD. (2000). Quality of health care and the HMO marketplace. *Journal of the American Medical Association*, 283 (5): 604-605.

McMichael AJ. (1988). Carcinogenicity of benzene, toluene and xylene: epidemiological and experimental evidence. International Agency for Research on Cancer Scientific Publications, 85: 3-18.

McMichael AJ. (1994). Molecular epidemiology. New pathway or new travelling companion?. *American Journal of Epidemiology*, 140 (1): 1-11.

McMichael AJ. (1995). Planetary overload: global environmental change and the health of the human species. New York: Cambridge University Press.

McMichael AJ. (1999). Prisoners of the proximate: loosening the constraints on epidemiology in an age of change. *American Journal of Epidemiology*, 149 (10): 887-897.

McNabb SJ, Ratard RC, Horan JM, Farley TA. (1994). Injuries to international petroleum drilling workers, 1988 to 1990. *Journal of Occupational Medicine*, 36 (6): 627-630.

McTaggart R. (1991). Action research: a short modern history. Melbourne: Deakin University.

Menotti V. (1998). Globalization and the acceleration of forest destruction since Rio. *The Ecologist*, 28 (6): 354-362.

Mergler D. (1987). Worker participation in occupational health research: theory and practice. *International Journal of Health Services*, 17 (1): 151-167.

Meyer J. (2000). Using qualitative methods in health related action research. *British Medical Journal*, 320 (7228): 178-181.

Mills PK, Newell GR, Johnson DE. (1984). Testicular cancer associated with employment in agriculture and oil and natural gas extraction. *Lancet*, 1 (8370): 207-210.



Ministry of Environment [Ministerio de Medio Ambiente]. (1999). Informe de inspección ambiental al área de las comunidades Flor de Manduro y Centro Manduro ubicadas en el bloque siete operado por la compañía Oryx. Quito: Ministerio de Medio Ambiente.

Mittelmark MB, Hunt MK, Heath GW, Schmid TL. (1993). Realistic outcomes: lessons from community-based research and demonstration programs for the prevention of cardiovascular diseases. *Journal of Public Health Policy*, 14 (4): 437-462.

Moberg D. (1997). Work ethics. *These Times*, March 31. [http://www.thirdworldtraveler.com/New\\_Global\\_Economy/WorkEthics\\_ITT.html](http://www.thirdworldtraveler.com/New_Global_Economy/WorkEthics_ITT.html).

Moffatt S, Phillimore P, Bhopal R, Foy C. (1995). "If this is what it's doing to our washing, what is it doing to our lungs?" Industrial pollution and public understanding in north-east England. *Social Science and Medicine*, 41 (6): 883-891.

Mohai P and Bryant B. (1992). Race poverty and the environment: the disadvantaged face greater risks. *Environmental Protection Agency Journal*, 18 (1): 6-8.

Montague P. (1998). The precautionary principle. *Rachel's Environment and Health Weekly* No. 586.

Montague P. (1999). The uses of scientific uncertainty. *Rachel's Environment and Health Weekly* No. 657.

Moreira JC. (1996). Threats by heavy metals: human and environmental contamination in Brazil. *The Science and the Total Environment*, 188 (suppl. 1): S61-S71.

Morgan G and Smirchich L. (1980). The case for qualitative research. *Academy of Management Review*, 5: 491-500.

Morgan G. (1997). *Imaginization*. Thousands Oaks, CA: Sage, pp 295-312.

Morita A, Kusaka Y, Deguchi Y, Moriuchi A, Nakanaga Y, Masayuki I, Miyazaki S, Kawahara K. (1999). Acute health problems among the people engaged in the cleanup of the Nakhodka oil spill. *Environmental Research*, 81 (3): 185-194.

Mouchet J, Le-Pont F, Leon R, Echeverria R, Guderian RH. (1994). Leishmaniasis in Ecuador. 5. Leishmaniasis and anthropization on the Pacific coast. *Annales de la Societé Belge de Medicine Tropical*, 74 (1): 35-41.

Muttitt G. (1999). Degrees of involvement. *The Ecologist*, 29 (5): 326-329.

Myers N. (1984). *The primary source: tropical forests and our future*. New York: Norton Press.

Myrick J. The social and environmental effects of the palm-oil industry in the Oriente of Ecuador. (1987). *Latin American Studies; Research Paper no. 19*. Albuquerque, New Mexico: University of New Mexico.



Nadon L, Siemiatycki J, Dewar R, Krewski D, Gerin M. (1995). Cancer risk due to occupational exposure to polycyclic aromatic hydrocarbons. *American Journal of Industrial Medicine*, 28 (3): 303-324.

Nakagawa H, Tabata M, Morikawa Y, Senma M, Kitagawa Y, Kawano S, Kido T. (1990). High mortality and shortened life-span in patients with itai-itai disease and subjects with suspected disease. *Archives of Environmental Health*, 45 (5): 283-287.

Nash J and Kirsch M. (1986). Polychlorinated biphenyls in the electrical machinery industry: an ethnological study of community action and corporate responsibility. *Social Science and Medicine*, 23 (2): 131-138.

Northridge ME, Yankura J, Kinney PL, Santella RM, Shepard P, Riojas Y, Aggarwal M, Strickland P. (1999). Diesel exhaust exposure among adolescents in Harlem: a community-driven study. *American Journal of Public Health*, 89 (7): 998-1002.

Oakley A. (1989). Who's afraid of the randomized controlled trial? Some dilemmas of the scientific method and "good" research practice. *Women's Health*, 15 (4): 25-59.

Odingo RS (ed.). (1979). An African Dam. Ecological survey of the Kamburu/Gtaru hydroelectric dam area, Kenya. *Ecological Bulletins*, vol. 29. Stockholm: Swedish Natural Science Research Council.

Olin RG, Ahlbom A, Lindberg-Navier I, Norell SE, Spannare B. (1987). Occupational factors associated with astrocytomas: a case-control study. *American Journal of Industrial Medicine*, 11 (6): 615-625.

Oliver SR. (1995). How can health service users contribute to the NHS research and development programme?. *British Medical Journal*, 310 (6990): 1318-1320.

Ortiz P and Varea A. (1995). La explotación petrolera en el Ecuador: historia e impactos socioambientales. In: Varea A and Ortiz P (eds.) *Marea negra en la Amazonía: conflictos socioambientales vinculados a la actividad petrolera en el Ecuador*. Quito: Abya-Yala, pp 71-88.

Ostro BD, Eskeland GS, Sanchez JM, Feyzioglu T. (1999). Air pollution and health effects: A study of medical visits among children in Santiago, Chile. *Environmental and Health Perspectives*, 107 (1): 69-73.

Oxy. (2001). [http://www.oxy.com/html/soc\\_resp1.htm](http://www.oxy.com/html/soc_resp1.htm).

Ozonoff D and Boden LI. (1987). Truth and consequences: health agency responses to environmental health problems. *Science, Technology and Human Values*, 12 (3-4): 70-77.

Ozonoff D, Colten ME, Cupples A, Heeren T, Schatzkin A, Mangione T, Dresner M, Colton T. (1987). Health problems reported by residents of a neighbourhood contaminated by a hazardous waste facility. *American Journal of Industrial Medicine*, 11 (5): 581-597.



Palinkas LA, Petterson JS, Russell J, Downs MA. (1993). Community patterns of psychiatric disorders after the Exxon Valdez oil spill. *American Journal of Psychiatry*, 150 (10): 1517-1523.

Pan American Health Organization. (1994). Health conditions in the Americas. Scientific Publication no. 549. Washington DC: Pan American Health Organization.

Pan American Health Organization. (1998). Health in the Americas. Washington DC: Pan American Health Organization.

Pan BJ, Hong YJ, Chang GC, Wang MT, Cinkotai FF, Ko YC. (1994). Excess cancer mortality among children and adolescents in residential districts polluted by petrochemical manufacturing plants in Taiwan. *Journal of Toxicology and Environmental Health*, 43 (1): 117-129.

Parker EA, Schulz AJ, Israel BA, Hollis R. (1998). Detroit's East Side Village Health Worker Partnership: community-based health advisor intervention in an urban area. *Health Education & Behavior*, 25 (1): 24-45.

Parkin DM. (1997). Cancer incidence in five continents. Lyon: International Agency for Research on Cancer.

Parson EA, Haas PM, Levy MA. (1992). A summary of the major documents signed at the Earth Summit and the Global Forum. *Environment*, 34 (4): 12-15, 34-36.

Pearce N. (1996). Traditional epidemiology, modern epidemiology, and public health. *American Journal of Public Health*, 86 (5): 678-683.

Pereira LA, Loomis D, Conceicao GM, Braga ALF, Arcas RM, Kishi HS, Singer JM, Bohm GM, Saldiva PH. (1998). Association between air pollution and intrauterine mortality in Sao Paulo, Brazil. *Environmental Health Perspectives*, 106 (6): 325-329.

Pershagen G. (1997). Interpretation of epidemiological studies with modestly elevated relative risks. In: Bate R (ed.) *What risk?*. Oxford: Butterworth-Heinemann, pp 191-200.

Petroecuador. (1995). Actividad hidrocarburífera en el país, periodo 1972-1995. Quito: Petroecuador.

Pha A. (2001). TNCs Stride the World. <http://www.igc.org/trac/corner/glob/guardian/>.

Pinter A, Rudnai P, Sarkany E, Goczan M, Paldy A. (1996). Air pollution and childrens' respiratory morbidity in the Tata area, Hungary. *Centro European Journal of Public Health*, 4 (suppl.): S17-S20.

Plough A and Olafson F. (1994). Implementing the Boston healthy start initiative: a case study of community empowerment and public health. *Health Education Quarterly*, 21 (2): 222-234.



Poole C, Dreyer NA, Satterfield MH, Lewin L, Rothman KJ. (1993). Kidney cancer and hydrocarbon exposure among petroleum refinery workers. *Environmental Health Perspectives*, 101 (suppl. 6): S53-S62.

Popay J and Williams G. (1996). Public health research and lay knowledge. *Social Science and Medicine*, 42 (5): 759-768.

Pope C and Mays N. (1995). Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. *British Medical Journal*, 311 (6996): 42-45.

Press E. (1999). Texaco on trial. *The Nation*, May 31.

Quinn M. (1991). *How to use qualitative methods in evaluation*. Newbury Park, CA: Sage.

Raabe GK and Wong O. (1996). Leukemia mortality by cell type in petroleum workers with potential exposure to benzene. *Environmental Health Perspectives*, 104 (suppl. 6): S1381-S1392.

Raffensperger C and Tickner J. (1999). *Protecting public health and the environment: implementing the precautionary principle*. Washington DC: Island Press.

Rainforest Action Network. (1998). *Drilling to the ends of the earth*. San Francisco: Rainforest Action Network. <http://www.moles.org/ProjectUnderground/motherlode/drilling/intro.html>.

Rainforest Action Network News. (1998). [http://www.ran.org/ran/ran\\_campaigns/amazonia/texaco\\_ecuador.html](http://www.ran.org/ran/ran_campaigns/amazonia/texaco_ecuador.html).

Ratner PA, Green LW, Frankish CJ, Chomik T, Larsen C. (1997). Setting the stage for health impact assessment. *Journal of Public Health Policy*, 18 (1): 67-79.

Reason P. (1994). Three approaches to participative inquiry. In: Denzin NK and Lincoln US (eds.) *Handbook of qualitative research*. Thousands Oaks, CA: Sage, pp 324-339.

Rebar AH, Lipscomb TP, Harris RK, Ballachey BE. (1995). Clinical and clinical laboratory correlates in sea otters dying unexpectedly in rehabilitation centers following the Exxon Valdez oil spill. *Veterinary Pathology*, 32 (4): 346-350.

Restrepo M, Muñoz N, Day NE, Parra JE, de Romero L, Nguyen-Dinh X. (1990). Prevalence of adverse reproductive outcomes in a population occupationally exposed to pesticides in Colombia. *Scandinavian Journal of Work and Environmental Health*, 16 (4): 232-238.

Rich B. (1994). *Mortgaging the earth: the World Bank, environmental impoverishment and the crisis of development*. London: Earthscan.

Ritzen A and Rosenstock L. (1993). The misuse of epidemiology and apportionment in compensation. *Environmental and Occupational Health Policy*, 3: 29-36.



- Rodeheaver DG and Cutrer JG. (1995). Environmental equity and the case of west Dallas. In: Ingman SR, Pei X, Ekstrom C, Friedsam H, Barlett K (eds.) An aging population, an aging planet and a sustainable future. Denton, TX: University of Texas, pp 213-233.
- Rodríguez MA, Martínez MC, Martínez-Ruiz D, Paz-Giménez M, Menéndez M, Repetto M. (1991). Death following crude oil aspiration. *Journal of Forensic Science*, 36 (4): 1240-1245.
- Roemer W, Hoek G, Brunekreef B. (2000). Pollution effects on asthmatic children in Europe, the PEACE study. *Clinical and Experimental Allergy*, 30 (8): 1067-1075.
- Ronneberg A, Haldorsen T, Romundstad P, Andersen A. (1999). Occupational exposure and cancer incidence among workers from an aluminum smelter in western Norway. *Scandinavian Journal of Work and Environmental Health*, 25 (3): 207-214.
- Ross DA and Vaughan JP. (1984). Health interview surveys in developing countries. Evaluation and Planning Centre for Health Care. London: London School of Hygiene and Tropical Medicine.
- Rothman KJ. (1990). A sobering start for the cluster busters' conference. *American Journal of Epidemiology*, 132 (suppl. 1): S6-S13.
- Rothman KJ and Greenland S. (1998). *Modern epidemiology*. Philadelphia: Lippincott-Raven.
- Rothman KJ and Poole C. (1998). Our conscientious objection to the epidemiology wars. *Journal of Epidemiology and Community Health*, 52 (10): 613-614.
- Rothman KJ, Adami HO, Trichopoulos D. (1998). Should the mission of epidemiology include the eradication of poverty?. *Lancet*, 352 (9130): 810-812.
- Rupa DS, Reddy PP, Reddi OS. (1991). Reproductive performance in population exposed to pesticides in cotton fields in India. *Environmental Research*, 55 (2): 123-128.
- Rushton L. (1993). A 39-year follow-up of the UK oil refinery and distribution center studies: results from kidney cancer and leukemia. *Environmental Health Perspectives*, 101 (suppl. 6): 77-84.
- Salinas M and Vega J. (1995). The effect of outdoor air pollution on mortality risk: an ecological study from Santiago, Chile. *World Health Statistics Quarterly*, 48 (2): 118-125.
- San Sebastián M and Córdoba JA. (1999). Informe Yana Curi: impacto de la actividad petrolera en la salud de las poblaciones de la Amazonía ecuatoriana. Coca, Ecuador: Cicame.
- San Sebastian M. (2000). Informe Yana Curi: impacto de la actividad petrolera en la salud de poblaciones rurales de la Amazonia ecuatoriana. Quito: Cicame and Abya-Yala.
- San Sebastian M, Armstrong B, Stephens C. (2000a). Reproductive health of women living in the proximity of oil fields in the Amazon basin of Ecuador. Oral presentation at the 12<sup>th</sup> Congress of the International Society of Environmental Epidemiology (ISEE); Buffalo, USA.



San Sebastian M, Armstrong B, Stephens C. (2000b). Health status of women living in the proximity of oil fields in the Amazon basin of Ecuador. Thematic poster discussion at the 12<sup>th</sup> Congress of the International Society of Environmental Epidemiology (ISEE); Buffalo, USA.

San Sebastian M, Armstrong B, Stephens C. (2000c). Environmental exposure and cancer incidence near oil fields in the Amazon basin of Ecuador. Thematic poster discussion at the 12<sup>th</sup> Congress of the International Society of Environmental Epidemiology (ISEE); Buffalo, USA.

San Sebastian M, Armstrong B, Stephens C. (2001a). Environmental exposure and cancer incidence near oil fields in the Amazon basin of Ecuador. Occupational and Environmental Medicine (in press).

San Sebastian M, Armstrong B, Stephens C. (2001b). Condiciones de salud de las mujeres que viven en la proximidad de campos de petróleo. Revista Panamericana de Salud Pública (in press).

San Sebastian M, Armstrong B, Stephens C. (2001c). Reproductive health of women living in the proximity of oil fields in the Amazon basin of Ecuador. International Journal of Epidemiology (submitted).

Sandman PM. (1991). Emerging communication responsibilities of epidemiologists. Journal of Clinical Epidemiology, 44 (suppl. 1): S41-S50.

Sans S, Elliott P, Kleinschmidt I, Shaddick G, Pattenden S, Walls P, Grundy C, Dolk H. (1995). Cancer incidence and mortality near the Baglan Bay petrochemical works, South Wales. Occupational and Environmental Medicine, 52 (4): 217-224.

Sathiakumar N, Delzell E, Cole P, Brill I, Frisch J, Spivey G. (1995). A case-control study of leukemia among petroleum workers. Journal of Occupational and Environmental Medicine, 37 (11): 1269-1277.

Satin KP, Wong O, Yuan LA, Bailey WJ, Newton KL, Wen CP, Swencicki RE. (1996). A 50-year mortality follow-up of a large cohort of oil refinery workers in Texas. Journal of Occupational and Environmental Health, 38 (5): 492-506.

Saurina C, Barcelo MA, Saez M, Tobias A. (1999). Estudio multicéntrico español sobre la relación entre la contaminación atmosférica y la mortalidad [The short-term effects of air pollution on mortality. The results of the EMECAM project in the city of Barcelona, 1991-1995]. Revista Española de Salud Pública, 73 (2): 199-207.

Savitz DA and Andrews KW. (1997). Review of epidemiologic evidence on benzene and lymphatic and hematopoietic cancers. American Journal of Industrial Medicine, 31 (3): 287-295.

Savitz DA, Poole C, Miller WC. (1999). Reassessing the role of epidemiology in public health. American Journal of Public Health, 89 (8): 1158-1161.



Saxton WL, Newton RT, Rorberg J, Sutton J, Johnson LE. (1993). Polycyclic aromatic hydrocarbons in seafood from the Gulf of Alaska following a major crude oil spill. *Bulletin of Environmental and Contamination Toxicology*, 51 (4): 515-522.

Scally G. (1996). Citizen health. *Lancet*, 347 (8993): 3-4.

Schaefer M. (1993). Health, environment and development: approaches to drafting country-level strategies for human well-being under Agenda 21. Geneva: World Health Organization.

Schreiner CA. (1984). Petroleum and petroleum products: a brief review of studies to evaluate reproductive effects. In: Christian MS, Galbraith WM, Voytek P, Mehlman MA (eds.) *Advances in modern environmental toxicology*, vol. III, Assessment of reproductive and teratogenic hazards. Princeton, NJ: Princeton Scientific Publishers, pp 29-45.

Schnorr TM, Grajewski BA, Hornung RW, Thun MJ, Egeland GM, Murray WE, Conover DL, Halperin WE. (1991). Video display terminals and the risk of spontaneous abortions. *The New England Journal of Medicine*, 324 (11): 727-733.

Scott-Samuel A. (1998). Health impact assessment – theory into practice. *Journal of Epidemiology and Community Health*, 52 (11): 704-705.

Seeley JA, Kengeya-Kayondo JF, Mulder DW. (1992). Community-based HIV/AIDS research, whither community participation? Unsolved problems in a research programme in rural Uganda. *Social Science and Medicine*, 34 (10): 1089-1095.

Selevan SG, Lindbohm ML, Hornung RW, Hemminki K. (1985). A study of occupational exposure to antineoplastic drugs and fetal loss in nurses. *The New England Journal of Medicine*, 313 (19): 1173-1178.

Sewell CM, Castle SP, Hull HF, Wiggins C. (1986). Testicular cancer and employment in agriculture and oil and natural gas extraction. *Lancet*, 1 (8480): 553.

Seymour J. (1991). Science on your doorstep. *New Scientist*, 7: 50-52.

Shallenberger LG, Acquavella JF, Donaleski D. (1992). An updated mortality study of workers in three major United States refineries and chemical plants. *British Journal of Industrial Medicine*, 49 (5): 345-354.

Sharma-Wagner S, Chokkalingam AP, Malaker HS, Stone BJ, McLaughlin JK, Hsing AW. (2000). Occupation and prostate cancer risk in Sweden. *Journal of Occupational and Environmental Medicine*, 42 (5): 517-525.

Shell Report. (2000). How do we stand?. <http://www.shell.com/>.

Shell. (2001). <http://www.shell.com/royal-en/directory/0,5029,25413,00.html>.

Shrybman S. (1999). The World Trade Organisation: the new world constitution laid bare. *The Ecologist*, 29 (4): 270-275.



- Shy CM. (1997). The failure of academic epidemiology: witness for the prosecution. *American Journal of Epidemiology*, 145 (6): 479-486.
- Siemiatycki J, Dewar R, Nadon L, Gerin M, Richardson L, Wacholder S. (1987). Associations between several sites of cancer and twelve petroleum-derived liquids. Results from a case-referent study in Montreal. *Scandinavian Journal of Work and Environmental Health*, 13 (6): 493-504.
- Silva-Luvecce J. (1976). *Nacionalismo y petróleo en el Ecuador actual*. Quito: Universitaria.
- Smith D. (1998). What does globalisation mean for health?. CMC-Churches' Action for Health, Unit II, No. 159. <http://www.pha2000.org/analytical.htm>.
- Smith NJH and Schultes RE. (1990). Deforestation and shrinking crop gene-pools in Amazonia. *Environment Conservation*, 17: 227-234.
- Smith SE, Pyrch T, Ornelas-Lizardi A. (1993). Participatory action-research for health. *World Health Forum*, 14 (3): 319-324.
- Sociedad de Lucha contra el Cáncer. (1998). *Cáncer en Quito; anuario 1995-1996*. Quito: Sociedad de Lucha contra el Cáncer.
- Sorahan T and Lancashire RJ. (1997). Lung cancer mortality in a cohort of workers employed at a cadmium recovery plant in the United States: an analysis with detailed job histories. *Occupational and Environmental Medicine*, 54 (3): 194-201.
- Spitzer WO, Dales RE, Schechter MT, Suissa S, Tousignant P, Steinmetz N, Hutcheon ME. (1989). Chronic exposure to sour gas emissions: meeting a community concern with epidemiologic evidence. *Canadian Medical Association Journal*, 141 (7): 685-691.
- Starrin B and Svensson PG. (1991). Participatory research: a complementary research approach in public health. *European Journal of Public Health*, 1: 29-35.
- Stata Corporation. (1999). *Stata Reference Manual*. Texas: Stata Press.
- Stephens C. (2000). Globalisation is killing us. *Health matters*, 41: 6-8.
- Stephens C, Lewin S, Leonardi G, San Sebastián M, Shaw R. (2000). Health, sustainability and equity: global trade in the brave new world. *Global change and human health*, 1 (1): 44-58.
- Stern FB, Halperin WE, Hornung RW, Ringenburg VL, McCammon CS. (1988). Heart disease mortality among bridge and tunnel officers exposed to carbon monoxide. *American Journal of Epidemiology*, 128 (6): 1276-1288.
- Stone DB, Armstrong WR, Macrina DM, Pankau JW. (1996). *Introduction to epidemiology*. Dubuque, IA: Brown & Benchmark.



Stücker I, Caillard JF, Collin R, Gout M, Poyen D, Hémon D. (1990). Risk of spontaneous abortion among nurses handling antineoplastic drugs. *Scandinavian Journal of Work and Environmental Health*, 16 (2): 102-107.

Susser M. (1998). Does risk factor epidemiology put epidemiology at risk? Peering into the future. *Journal of Epidemiology and Community Health*, 52 (10): 608-611.

Susser M and Susser E. (1996). Choosing a future for epidemiology: II. From black box to chinese boxes and eco-epidemiology. *American Journal of Public Health*, 86 (5): 674-677.

Suter GW. (1997). Integration of human health and ecological risk assessment [editorial]. *Environmental Health Perspectives*, 105 (12): 1282-1283.

Tabacova S and Vukow M. (1991). Developmental effects of environmental pollutants. In: East-West European initiative for research in reproductive health. Special programme for research, development and research training in human reproduction. Geneva: World Health Organization, pp 37-38.

Tabacova S and Balabaeva L. (1993). Environmental pollutants in relation to complications of pregnancy. *Environmental Health Perspectives*, 101 (suppl. 2): S27-S31.

Talbot D. (1999). Rain forest pays the price of oil: suit claims Texaco polluted Ecuador. *Boston Herald*, August 29.

Taylor R and Rieger A. (1985). Medicine as social science: Rudolf Virchow on the typhus epidemic in upper Silesia. *International Journal of Health Services*, 15 (4): 547-559.

Tchounwou PB, Abdelghani AA, Prammar YV, Heyer LR, Steward CM. (1996). Assessment of potential health risks associated with ingesting heavy metals in fish collected from a hazardous-waste contaminated wetland in Louisiana, USA. *Review of Environmental Health*, 11 (4): 191-203.

Terán C. (2000). Sucumbios 2000 número 1. Lago Agrio, Ecuador: Vicariato de Sucumbíos.

Teta MJ, Ott MG, Schnatter AR. (1991). An update of mortality due to brain neoplasms and other causes among employees of a petrochemical facility. *Journal of Occupational Medicine*, 33 (1): 45-51.

Texaco. (2001a). <http://www.texaco.com/she/index.html>.

Texaco. (2001b). [http://www.texaco.com/shared/position/docs/ecuador\\_d.html](http://www.texaco.com/shared/position/docs/ecuador_d.html).

The First Panum Lecture. (1999). The future of epidemiology. *International Journal of Epidemiology*, 28 (5): S996-S1023.

The Guardian. (2001). Oil in troubled waters, January 24.

Theriault G and Provenchor S. (1987). Mortality study of oil refinery workers: five-year follow-up. *Journal of Occupational Medicine*, 29 (4): 357-360.



- Thomas PT. (1995). Pesticide-induced immunotoxicity: are Great Lakes residents at risk? *Environmental Health Perspectives*, 103 (suppl. 9): S55-S61
- Tognoni G (ed.). (1997). *Manual de epidemiología comunitaria*. Esmeraldas, Ecuador: Cecomet.
- Tolbert PE, Mulholland JA, MacIntosh DL, Xu F, Daniels D, Devine OJ, Carlin BP, Klein M, Dorley J, Butler AJ, Nordenberg DF, Frumkin H, Ryan PB, White MC. (2000). Air quality and pediatric emergency room visits for asthma in Atlanta, Georgia, USA. *American Journal of Epidemiology*, 151 (8): 798-810.
- Travers KD. (1997). Reducing inequities through participatory research and community empowerment. *Health Education & Behavior*, 24 (3): 344-356.
- Truscott B, Walsh JM, Burton MP, Payne JF, Idler DR. (1983). Effect of acute exposure to crude petroleum on some reproductive hormones in salmon and flounder. *Comparative Biochemistry and Physiology. Part C*, 75: 121-130.
- Tsai SP, Gilstrap EL, Cowles SR, Snyder PJ, Ross CE. (1993). A cohort mortality study of two California refinery and petrochemical plants. *Journal of Occupational Medicine*, 35 (4): 415-421.
- Tsai SP, Waddell LC, Gilstrap EL, Ransdell JD, Ross CE. (1996). Mortality among maintenance employees potentially exposed to asbestos in a refinery and petrochemical plant. *American Journal of Industrial Medicine*, 29 (1): 89-98.
- Unión de Promotores Populares de Salud de la Amazonía Ecuatoriana. (1993). *Culturas bañadas en petróleo: diagnóstico de salud realizado por promotores*. Quito: Abya-Yala.
- United Church of Christ Commission for Racial Justice. (1987). *Toxic waste and race in the United States: a national report on the racial and socio-economic characteristics of communities with hazardous waste sites*. New York: United Church of Christ.
- United Nations Children's Fund. (1992). *Situación de las madres y los niños en zonas de grandes proyectos*. Quito: UNICEF.
- United Nations Development Programme. (2001). <http://www.undp.org/csopp/CSO/NewFiles/ipresourceconf.html>.
- United Nations Environmental Programme. (1999). *Global environment outlook*. Nairobi, Kenya: Earthscan Publications.
- United States Department of State (1998). *Background Notes: Ecuador*. [http://www.state.gov/www/background\\_notes/ecuador\\_1198\\_bgn.html](http://www.state.gov/www/background_notes/ecuador_1198_bgn.html).
- United States Environmental Protection Agency. (1986). *Quality criteria for water*. Washington DC: USEPA Office of Water, Regulations and Standards.
- Van Der Meer DC. (1993). NAFTA prompts health concerns across the borders [news]. *Environmental Health Perspectives*, 101 (3): 230-231.



- Vandenbroucke JP. (1994). New public health and old rhetoric [editorial]. *British Medical Journal*, 308 (6935): 994-995.
- Varea A. (1995). Falta de transparencia en el manejo de información sobre la auditoría ambiental a la compañía Texaco. In: Varea A and Ortiz P (eds.) *Marea negra en la Amazonía: conflictos socioambientales vinculados a la actividad petrolera en el Ecuador*. Quito: Abya-Yala, pp 295-338.
- Vidal J. (1994). The GATT effect. Gland, Switzerland: World Wide For Nature. <http://www.panda.org/resources/publications/sustainability/gatt/index.htm>
- Voigt T, Bailey M, Abramson M. (1998). Air pollution in the Latrobe Valley and its impact upon respiratory morbidity. *Australian and New Zealand Journal of Public Health*, 22 (5): 556-561.
- Waalkes MP and Rehm S. (1994). Cadmium and prostate cancer. *Journal of Toxicology and Environmental Health*, 43 (3): 251-256.
- Wadsworth Y. (1984). *Do it yourself: social research*. Melbourne: Victorian Council of Social Services.
- Waitzkin J. (1981). The social origins of illness. *International Journal of Health Services*, 11 (1): 77-103.
- Wallach L and Sforza M. (1999). *Whose trade organization? Corporate globalization and the erosion of democracy*. Washington DC: Public Citizen Inc.
- Wallerstein N. (1992). Powerlessness, empowerment and health: implications for health promotion programs. *Health Promotion*, 6: 197-205.
- Walker AM. (1997). "Kangaroo court": Invited commentary on Shy's "The failure of academic epidemiology: witness for the prosecution". *American Journal of Epidemiology*, 145 (6): 485-486.
- Walsh JF, Molyneux DH, Birley MH. Deforestation: effects on vector-borne disease. *Parasitology* 1993; 106 (suppl.): S55-S75.
- Walt G. (1994). *Health policy: an introduction to process and power*. London: Zed Books.
- Walt G. (2000). Globalization and health. Paper presented at the Medact Meeting on 13 May. <http://www.pha2000.org/analytical.htm>.
- Walters P, Khan S, O'Brien PJ, Payne JF, Rahimtula AD. (1987). Effectiveness of a Prudhoe Bay crude oil and its aliphatic, aromatic and heterocyclic fractions in inducing mortality and aryl hydrocarbon hydroxylase in chick embryo in ovo. *Archives of Toxicology*, 60 (6): 454-459.
- Ware JH, Spengler JD, Neas LM, Samet JM, Wagner GR, Coultas D, Ozkaynak H, Schwab M. (1993). Respiratory and irritant health effects of ambient volatile organic compounds. The Kanawha County Health Study. *American Journal of Epidemiology*, 137 (12): 1287-1301.



Watterson A. (1994). Whither lay epidemiology in UK public health policy and practice? Some reflections on occupational and environmental health opportunities. *Journal of Public Health Medicine*, 16 (3): 270-274.

Wegman DH. (1996). Air pollution. In: Bertollini R, Lebowitz MD, Saracci R, Savitz DA (eds.) *Environmental epidemiology: exposure and disease*. Geneva: World Health Organization.

Weinberg CR. (1993). Toward a clearer definition of confounding. *American Journal of Epidemiology*, 137 (1): 1-8.

Weindling P. (1985). *The social history of occupational health*. London: Croom Helm.

Werner D. (2000). Communication as if people mattered. Working paper prepared for The Peoples' Health Assembly. Bangladesh, December. <http://www.pha2000.org/analytical.htm>.

Whitehead M. (1993). The ownership of research. In: Davies JK and Kelly MP (eds.) *Healthy cities: research and practice*. New York: Routledge.

Wilcox AJ and Horney LF. (1984). Accuracy of spontaneous abortion recall. *American Journal of Epidemiology*, 120 (5): 727-733.

Wilcox AJ, Weinberg CR, O'Connor JF, Baird DD, Schlatterer JP, Canfield RE, Armstrong EG, Nisula BC. (1988). Incidence of early loss of pregnancy. *New England Journal of Medicine*, 319 (4): 189-194.

Wilkinson P, Thakrar B, Walls P, Landon M, Falconer S, Grundy C, Elliott P. (1999). Lymphohaematopoietic malignancy around all industrial complexes that include major oil refineries in Great Britain. *Occupational and Environmental Medicine*, 56 (9): 577-580.

Wilkinson R. (1996). *Unhealthy societies: the affliction of inequalities*. London: Routledge.

Williams B. (1997). Oxy's strategy on environment: community issues, key to success of project in Ecuador's rainforest. *Oil and Gas Journal*, 21: 44-45.

Willms D, Singer SM, Adrien A, Godin G, Maticka-Tyndale E, Cappon E. (1996). Participative aspects in the qualitative research design of phase II of the ethnocultural communities facing AIDS study. *Canadian Journal of Public Health*, 87 (suppl. 1): S15-S32.

Wilson JS and Holland LM. (1988). Periodic response difference in mouse epidermis chronically exposed to crude-oils or BaP: males vs. females. *Toxicology*, 50 (1): 83-94.

Wing S. (1994). Limits of epidemiology. *Medicine and Global Survival*, 1 (2): 74-86.

Wing S. (1998). Whose epidemiology, whose health?. *International Journal of Health Services*, 28 (2): 241-252.

Witten K, Parkes M, Ramasubramanian L. (2000). Participatory environmental health research in Aotearoa/New Zealand: constraints and opportunities. *Health Education & Behavior*, 27 (3): 371-384.



Wolf MS, Toniolo PG, Lee EW, Rivera M, Dubin N. (1993). Blood levels of organochlorine residues and risk of breast cancer. *Journal of the National Cancer Institute*, 85 (8): 648-652.

Wolfe M. (1995). Globalization and social exclusion: some paradoxes. In: Rodgers G, Gore C, Figueiredo J (eds.) *Social exclusion: rhetoric, reality and responses*. Geneva: International Labour Organization, pp 81-103.

Women's Environmental Network. (1999). *Putting breast cancer on the map*. London: The Women's Environmental Network.

Wong O. (1987). An industry wide mortality study of chemical workers occupationally exposed to benzene. I. General results. *British Journal of Industrial Medicine*, 44 (6): 365-381.

Wongsrichanalai C, Delzell E, Cole P. (1989). Mortality from leukemia and other diseases among workers at a petroleum refinery. *Journal of Occupational Medicine*, 31 (2): 106-111.

World Bank. (1994). *World Development Report: investing in infrastructure*. New York: Oxford University Press.

World Bank. (1997). *Trends in Developing Economies*. <http://www.worldbank.org/html/extdr/offrep/lac/ec.htm>.

World Bank. (2001). *Ecuador overview*. <http://www.worldbank.org>.

World Business Council for Sustainable Development. (1998). *Trade, Environment and Sustainable Development: A Briefing Manual*. Geneva: World Business Council for Sustainable Development.

World Business Council for Sustainable Development. (2001). <http://www.wbcsd.ch/corp1.htm>.

World Health Organization. (1978). *Alma Ata. Primary Health Care. Health for All series No. 1*. Geneva: World Health Organization.

World Health Organization. (1981). *Global strategy for health for all by the year 2000*. Geneva: World Health Organization.

World Health Organization. (1984). *Principles for evaluating health risks to progeny associated with exposure to chemicals during pregnancy*. Geneva: World Health Organization.

World Health Organization. (1992). *Commission on Health and Environment. Our planet, our health*. Geneva: World Health Organization.

World Health Organization. (1996). *Guidelines for drinking-water quality. Volume 1*. Geneva: World Health Organization.

World Resources Institute. (1990). *World Resources 1990-91*. New York: Oxford University Press.



Xu X, Cho SI, Sammel M, You L, Cui S, Huang Y, Ma G, Padungtod C, Pothier L, Niu T, Christiani D, Smith T, Ryan L, Wang L. (1998). Association of petrochemical exposure with spontaneous abortion. *Occupational and Environmental Medicine*, 55 (1): 31-36.

Yach D. (1992). The use and value of qualitative methods in health research in developing countries. *Social Science and Medicine*, 35 (4): 603-612.

Yamato O, Goto I, Maede I. (1996). Haemolytic anaemia in wild seaducks caused by marine oil pollution. *Journal of Wildlife Diseases*, 32 (2): 381-384.

Yang C and Zhang X. (1991). Incidence survey of leukemia in China. *Chinese Medicine and Science Journal*, 6 (2): 65-70.

Yang CY, Chiu HF, Chiu JF, Kao WY, Tsai SS, Lan SJ. (1997). Cancer mortality and residence near petrochemical industries in Taiwan. *Journal of Toxicology and Environmental Health*, 50 (3): 265-273.

Zahm SH, Ward MH, Blair A. (1997). Pesticides and cancer. *Occupational Medicine*, 12 (2): 269-289.

Zeballos JV. (1981). El Estado ecuatoriano y las transnacionales petroleras: ocho años de alianza y conflicto, 1972-1979. Quito: Universidad Católica.

Zehner R, Villacreces LA. (1998). Estudio de la calidad de aguas de río en la zona de amortiguamiento del Parque Nacional Yasuní. Primera fase: monitoreo de aguas - screening Octubre de 1997. Coca, Ecuador: Laboratorio de Aguas y Suelos P. Miguel Gamboa-Fepp.



## APPENDIX 1

### THE ECUADORIAN SCENARIO

#### 1. Demographic characteristics

The Republic of Ecuador is located in north-western South America, bordered by Colombia to the north, Peru to the south and east, and the Pacific Ocean to the west. Its land area of approximately 272,000 km<sup>2</sup> comprises four well-defined geological zones: the highlands, the coastal, and the Amazon (El "Oriente") regions on the continent, and the Galapagos Islands in the Pacific. The official language is Spanish, although other languages are also spoken. Ecuador's population is ethnically mixed. The largest ethnic groups are indigenous (40%) and *mestizo* (mixed Indian-Caucasian).

In 1997, Ecuador's population was estimated at 11,936,858, of which 55.4% lived in urban areas. The population growth rate was 2.1% in the last intercensal period (1982–1990), and the annual rate for 1995–2000 is estimated at 1.9%. In 1995 the population less than 15 years of age represented 36.4% of the total, as opposed to 38.9% in 1990. In the year 2000 this age group will represent 33.8% of the total population. In 1995, 49.8% of the population lived in coastal regions, 44.8% in the mountains, 4.6% in the Amazon region, 0.1% on the islands, and 0.7% in areas without geopolitical boundaries (Pan American Health Organisation, 1998).



#### 2. Political history of Ecuador

Four key themes have dominated the historical landscape and remained essential to an understanding of contemporary Ecuador. First, the nation has a highly skewed social structure that can be traced to its colonial past. Second, persistent regional rivalries often have



determined the outcome of key national issues. Third, the economy continues to be subject to the fortunes of a single commodity. Finally, the political system lacks strong, stable institutions.

Spanish social structures and values took hold most completely in the sixteenth century in the *Sierra* (Andean highlands). Spanish officials adapted the prevailing Inca hierarchical social system and established a tripartite, semi-feudal structure consisting of small numbers of white elites (both peninsulars, Spanish-born persons residing in the New World and *criollos* persons of pure Spanish descent born in the New World), a somewhat larger group of *mestizo* artisans and a large indian underclass. Since Ecuador lacked the mineral riches found in other Spanish colonies, such as Peru and Mexico, land became the critical commodity. Through the *encomienda* system, elites received tracts of *Sierra* land along with the right to extract labour from indians living on that land (Hanratty, 1989).

The successful struggle for independence in the 1820s resulted in the transfer of power from *peninsulars* to *criollos*. It did little, however, to change other aspects of the social system, which by then had become dominated by *haciendas* with a resident Indian labour force.

An intense rivalry between Guayaquil and Quito -the national capital and most important *Sierra* city- dominated nineteenth-century Ecuadorian politics. By the 1850s, a clear dichotomy had emerged between the Catholic, conservative *Sierra* and the anticlerical, liberal *Costa* <sup>21</sup>. The 19th century was marked by instability, with a rapid succession of rulers. The conservative Gabriel Garcia Moreno unified the country in the 1860s with the support of the Catholic Church. In the late 1800s, world demand for cocoa tied the economy to commodity exports and led to migrations from the highlands to the agricultural frontier on the coast. A coastal-based liberal revolution in 1895 under Eloy Alfaro reduced the power of the clergy and opened the way for capitalist development.

The end of the cocoa boom produced renewed political instability and a military coup in 1925. The 1930s and 1940s were marked by populist politicians such as five-time president

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<sup>21</sup> This would remain the major sphere of political struggle even in the 1980s and 1990s. Despite the presence of large squatter communities in both cities, regional rather than class identification has remained the most important determinant of voting behaviour. For example, a majority of *Costa* voters supported the second-round presidential candidates from their region in the 1984, 1988 and 1992 elections, even though the political ideologies of these candidates varied widely (Fundación José Peralta, 1999).



Jose Velasco Ibarra. In January 1942, Ecuador signed the Rio Protocol to end a brief war with Peru the year before; Ecuador agreed to a border that conceded to Peru much territory Ecuador previously had claimed in the Amazon. After World War II, a recovery in the market for agricultural commodities and the growth of the banana industry helped restore prosperity and political peace. From 1948-60, three presidents--beginning with Galo Plaza--were freely elected and completed their terms.

Recession and popular unrest led to a return to populist politics and domestic military interventions in the 1960s, while foreign companies developed oil resources in the Ecuadorian Amazon. In 1972, a nationalist military regime seized power and used the new oil wealth and foreign borrowing to pay for a program of industrialisation, land reform, and subsidies for urban consumers. With the oil boom fading, Ecuador returned to democracy in 1979, but by 1982 the government faced a chronic economic crisis, including inflation, budget deficits, a falling currency, mounting debt service, and uncompetitive industries.

The 1984 presidential elections were narrowly won by Leon Febres-Cordero of the Social Christian Party (PSC). During the first years of his administration, Febres-Cordero introduced free-market economic policies, took strong stands against drug trafficking and terrorism, and pursued close relations with the United States. His tenure was marred by bitter wrangling with other branches of government and his own brief kidnapping by elements of the military. A devastating earthquake in March 1987 interrupted oil exports and worsened the country's economic problems.

Rodrigo Borja of the Democratic Left (ID) party won the presidency in 1988. His government was committed to improving human rights and carried out some reforms, notably an opening of Ecuador to foreign trade. The Borja government concluded an accord leading to the disbanding of the small terrorist group, "Alfaro Lives." However, continuing economic problems undermined the popularity of the ID, and opposition parties gained control of Congress in 1990.

In 1992, Sixto Duran-Ballen won in his third run for the presidency. His government's popularity suffered from tough macroeconomic adjustment measures, but it succeeded in pushing a limited number of modernisation initiatives through Congress. Duran-Ballen's vice president, Alberto Dahik, was the architect of the administration's economic policies, but in



1995 Dahik fled the country to avoid prosecution on corruption charges following a heated political battle with the opposition. A war with Peru erupted in January-February 1995 in a small, remote region where the boundary prescribed by the 1942 Rio Protocol is in dispute.

Abdala Bucaram, from the Guayaquil-based Ecuadorian Roldosista Party (PRE), won the presidency in 1996 on a platform that promised populist economic and social reforms and the breaking of what Bucaram termed as the power of the nation's oligarchy. During his short term of office, Bucaram's administration drew criticism for corruption. Bucaram was deposed by the Congress in February 1997 on grounds of alleged mental incompetence. In his place, Congress named Interim President Fabian Alarcon, who was President of Congress and head of the small Radical Alfarist Front party. Alarcon's interim presidency was endorsed by a May 1997 popular referendum.

The interim government proved ineffective not only in advancing structural reform, but also in managing the economy, particularly when oil-export prices declined sharply and El Niño rains caused severe damage. In July 1998, Jamil Mahuad was elected President and sworn in August 1998. Mahuad's Administration quickly signed a peace accord with Peru, but as the economic and banking problems deepened during 1999, it was compelled to devote most of its energies coping with these problems. Partly because of its weak executive powers, limited political base, and inadequate administrative powers, the Mahuad Government proved unable to prevent the crisis from deepening. In January 2000, less than two weeks after precipitous exchange-rate depreciation essentially forced him to announce that the economy would dollarize, President Mahuad was forced from office by a military-civilian coup attempt. A junta proved short-lived when the Armed Forces withdrew their support, and Vice President Gustavo Noboa took over as President, thereby maintaining the constitutional system (Hanratty, 1989, United States Department of State, 1998; Fundación José Peralta, 1999; World Bank, 2001).

### **3. Socio-economic situation**

On the economic front, the small size of Ecuador's economy has meant that historically its development and growth have come from external markets. Periods of high economic growth have therefore mainly resulted from export booms. This development pattern, with inadequate export diversification and internal development, has left the economy vulnerable to terms-of-trade shocks. Such shocks, together with the rigidities of the domestic economy, lagging



structural reform in the public and financial sectors, and the inadequate policy responses, have negatively affected economic and social development (World Bank, 2001).

Until the 1970's, Ecuador was an agrarian country dependent on commodity exports. Boom periods were linked to high world prices for coastal products, such as cacao and bananas. Starting in 1972, oil development in the Amazon basin fuelled a decade of rapid growth, averaging 9% annually, that financed expanded public services, state enterprises, infrastructure, and import-substitution manufacturing. In the early 1980s, the economy faltered as the international price of petroleum began a gradual decline and the country lost some foreign markets for its traditional agricultural products. In addition, during this decade Ecuador experienced a global recession, a dramatic increase in international interest rates, widespread crop and transportation damage caused by El Niño, and an earthquake that severed the oil pipeline for 5 months. Consequently the 1980's were a decade of stagnation under the burdens of debt, inflation, incomplete adjustment measures, and volatile international oil prices. From that time, Ecuador began the implementation of market-oriented structural reforms, which so far have failed to create sustainable growth (Hanratty, 1989; Kimerling, 1991; Fundación José Peralta, 1999).

Petroleum production and agricultural exports continue to form the pillars of the Ecuadorian economy. The largely state-operated petroleum sector accounts for about one third of both public sector revenue and export earnings, ensuring a favourable balance of trade. Ecuador is the world's largest exporter of bananas and a major producer of shrimp, which together account for another third of the country's exports. Cocoa, coffee, and tuna are also exported. Non-traditional agricultural products, such as flowers and winter vegetables, are becoming more important. Ecuador's farmers also produce a variety of domestic consumption crops. Industry is largely oriented to producing for the domestic market, but regional economic integration is creating more export opportunities for manufacturers. The services sector provides some modern infrastructure and a significant tourism industry. Ecuador has extensive, but underdeveloped, gold and other mining potential (Fundación José Peralta, 1999; World Bank, 2001).

During the oil boom of the 1970s, the government borrowed heavily from abroad, increased subsidies, and expanded the state's economic role. Such policies became unsustainable, leading to chronic macroeconomic instability in the 1980s. President Duran-Ballen took office



in 1992 promising to stabilise the economy, modernise the state, and expand the free market. A sizeable devaluation of the sucre in 1992, large public-sector price hikes, market pricing of fuel, and spending reductions--together with monetary, budget, and tax reforms--reduced the public deficit. Inflation also fell from 60% to about 25%, but increased again to 30% in 1997. In 2000, inflation reached the highest value of its history, 92% (United States Department of State, 1998; World Bank, 2001).

Real GDP declined more than 7 percent in 1999, consumer prices rose 60.7 percent, unemployment surged, real wages plummeted, the sucre lost about 66 percent of its value against the U.S. dollar, and both poverty and income distribution worsened. Poverty incidence, which had already increased from 34 to 46 percent from 1995 to 1998, stood at continued to increase in 1999. About 88 percent of the rural population are now living in poverty, compared with 69 percent in 1999 and 54 percent in 1995. The number of people living in extreme poverty (insufficient income for a minimum food basket) had climbed from 15 to 17 percent from 1995 to 1998 and jumped to 34 percent of the population in 1999. The unemployment rate for the lowest income quintile doubled between May 1998 and August 1999 (16.9 percent) and is now also twice the average for the population as a whole (World Bank, 2001).

The Government announced in early March 2000 an economic and social program, whose objectives include restoring confidence in economic management, stemming the decline of economic activity, laying the foundations for renewed economic growth and preventing the further deterioration of living standards and protecting the poor. In April, the International Monetary Fund (IMF) and World Bank approved loans to help Ecuador recover from its economic difficulties. The IMF loan required the removal of domestic fuel subsidies, which increased the price of gasoline by 60%, and utility price increases. However, resistance to these reforms, mostly in the form of strikes, currently continues among indigenous communities, teachers, and various public sector employees (United States Department of State, 1998; World Bank, 2001).

#### **4. Health and education conditions**

In the last 25 years, crude mortality in Ecuador has fallen by more than a half, from 11.4 per 1,000 population in 1966 to 4.9 per 1,000 in 1991. Infant mortality fell from 76.6 per 1,000 live births in 1970 to 28.1 per 1,000 in 1991. However, in 1994, estimated infant mortality for



the country as a whole was at 44 per 1,000 live births. If this was due to a better registration system is not known. The magnitude of underregistration of mortality is estimated to be at least 30% (Pan American Health Organisation, 1998).

Acute respiratory infections were responsible for 37% of the deaths in infants from 1 week to 11 months of age and for 32% of deaths in children from 1 to 4 years old; they accounted for 28% and 24% of hospital discharges, respectively. The leading causes of death in adults from 20 to 59 years of age are cardiovascular and cerebrovascular diseases, malignant tumors, and accidents and violence. Pesticide poisoning is also a serious public health problem in Ecuador.

During these last years, a number of infectious diseases have concerned health officials. Tuberculosis, malaria, chagas and leishmaniasis in the deforested areas of the coast and coastal tropical forests, the cholera epidemic and the increasing number of HIV patients are major health problems (Pan American Health Organisation, 1998).

González et al. (1988) carried out a research between 1970-1981 looking for relationships among socio-economic factors and infant mortality rates. During this period infant mortality decreased in 35%. The study showed that the main factors influencing this reduction were the increase of the health and education budget and the decrease of the birth rate. No association was found with oil exports, GDP, land reform and urbanisation.

Yet macroeconomic policies have had a negative impact on the government's budget for the social sector: allocation for education and culture decreased from 29% in 1980 to 13.3% in 1991, and those for health went from 6.1% in 1980 to 5.9% in 1990 and 4.6% in 1996. Ninety percent of the 1992 budget went for salaries and limited operating costs and only 10% was used for investment projects. The distribution of these moneys is clearly inequitable and their utilisation is inefficient and centralised (Pan American Health Organisation, 1994; 1998).

It is estimated that fewer than half the children in poverty-stricken areas manage to finish primary school. Eight percent of the men and 12% of the women are illiterate; 30% of indigenous-language speakers are illiterate, compared with 10% of Spanish-speaking individuals. Only 53% of the indigenous population attends primary school, 15% is in



secondary school, and fewer than 1% is enrolled in institutions of higher learning (Pan American Health Organisation, 1998).



## **APPENDIX 2**

### **ECUADOR AND OIL DEVELOPMENT POLICIES**

Leaving behind decades of predominantly agricultural exports, Ecuador turned to oil production in the “Oriente” for its major source of income (12% of the GDP; 40% of the state budget) more than 25 years ago. Currently, Ecuador is an important player in world energy markets, Latin America's sixth largest crude oil producer and its fourth largest exporter. The oil price collapse of 1998-1999 had negative ramifications for the Ecuadorian oil industry, as maintenance was delayed and wells were shut in, although government revenues have increased in 2000 with the recovery of world oil prices (Environment Information Agency, 2001).

Recent government plans to strengthen the energy sector could boost the economy. However, Ecuador's ongoing political and financial crisis has made these reforms uncertain (Fundación José Peralta, 1999, World Bank, 2001).

#### **2.1. OIL HISTORICAL OVERVIEW**

The petroleum industry started in Ecuador in 1911, with the drilling of an oil well on the Santa Elena Peninsula, on the Pacific coast. Within a few decades, the search for oil shifted inland and east of the Andes to the rain forest of the “Oriente”. In 1937, Shell Oil was granted an oil concession spanning the entire region, but years of exploratory work and drilling yielded no commercial finds. In 1950, Shell deserted the “Oriente”.

In 1942, Ecuador lost nearly a third of its national territory when some one-half of its Amazon region was annexed by Peru. Standard Oil company encouraged Peru's aggression in order to explore a territory that the Ecuadorian government had previously granted them and later cancelled (Galarza, 1972). Today, rich quantities of petroleum are being extracted from annexed lands by Occidental Petroleum and the national oil company of Peru. The sequel of this incident extends till nowadays with different armed conflicts (1981, 1995) with lost of human lives and enormous economic spending (World Bank, 2001).

After more than a ten-year hiatus, Texaco/Gulf renewed the search for oil in the “Oriente”. In 1967, Texaco discovered a rich field of crude oil beneath an area surrounding the base camp



at Lago Agrio, in the north-eastern of the country. Texaco's surprising success prompted the Ecuadorian government to rethink its oil policy. Beginning in 1969, Ecuador claimed two-thirds of the Texaco/Gulf concessions, boosted production royalties, levied a land tax on foreign companies, and demanded that the companies made major investments in infrastructure. In 1971, Ecuador's military government passed the national Law of Hydrocarbons, which established a national oil company (Corporación Estatal Petrolera Ecuatoriana, CEPE), slashed the size of foreign concession again, and raised royalties still further.

In August 1972, the Texaco consortium completed the 498 km pipeline linking the oil fields with the refinery at the coast. Ecuador was soon the third largest exporter of oil in Latin America and became a member of the Organisation of Petroleum Exporting Countries, OPEC. In order to be free to produce more oil, Ecuador left OPEC in 1992.

During the 70s, the Ecuadorian government enhanced the role of Ecuador's national oil company. In 1976, Ecuador, in effect, forced Gulf to pull out and the national oil company became the major financial partner in the Texaco consortium. However, a world-wide recession and dwindling reserves prompted Ecuador to loosen the Law of Hydrocarbons in 1982, in order to attract renewed exploration and development on terms more favourable to foreign companies. In the next years, several foreign oil companies signed exploration service contracts with Ecuador (Martz, 1987; Kimerling, 1991).

Control and ownership of petroleum production and refinement process is now held by foreign oil companies, Petroecuador<sup>22</sup>, or consortia composed of both. At the moment, 16 companies are operating in the country; 1 private national, Petroecuador and 14 foreign companies (Table 2.1; Figure 2.1).

Virtually all of Ecuador's oil production comes from the "Oriente" region. Current oil production activities span nearly 1 million hectares in the "Oriente", and include over 300 producing wells and 29 production camps, producing roughly 380,000 barrels of crude per day (bbc/d). Ecuador contains approximately 2.1 billion barrels of proven oil reserves

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<sup>22</sup> In 1989, the national oil company CEPE was renamed Petroecuador.



(Environment Information Agency, 1997).

**Table 2.1. Oil companies operating in Ecuador, 2000. Source: El Comercio, 2000.**

COMPANY	COUNTRY	BLOCK	PROVINCE
Cayman	USA	18	Sucumbios (NP) *
City	USA	27	Sucumbios (WR)
Santa Fe	USA	11	Sucumbíos (NP)
Occidental	USA	15	Orellana, Sucumbíos (WR)
Vintage	USA	14, 17	Orellana (NP)
Repsol-YPF	Spain	16	Orellana (NP)
Kerr-McGee	USA	7, 21	Orellana, Pastaza
Perez Companc	Argentina	31	Orellana (NP)
Tritón	USA	19	Napo, Sucumbíos (PA)
Burlington	USA	24	Pastaza, Morona Santiago
AGIP	Italy	10	Pastaza , Morona Santiago (NP)
Tripetrol	Ecuador	4, 28	Guayas, Pastaza, Napo (PA)
CGC	France	2, 23	Guayas, Pastaza
Canada Grandé	Canada	2	Guayas
EDC	USA	3	Guayas
Petroecuador	Ecuador	The rest	(NP, PA, WR)

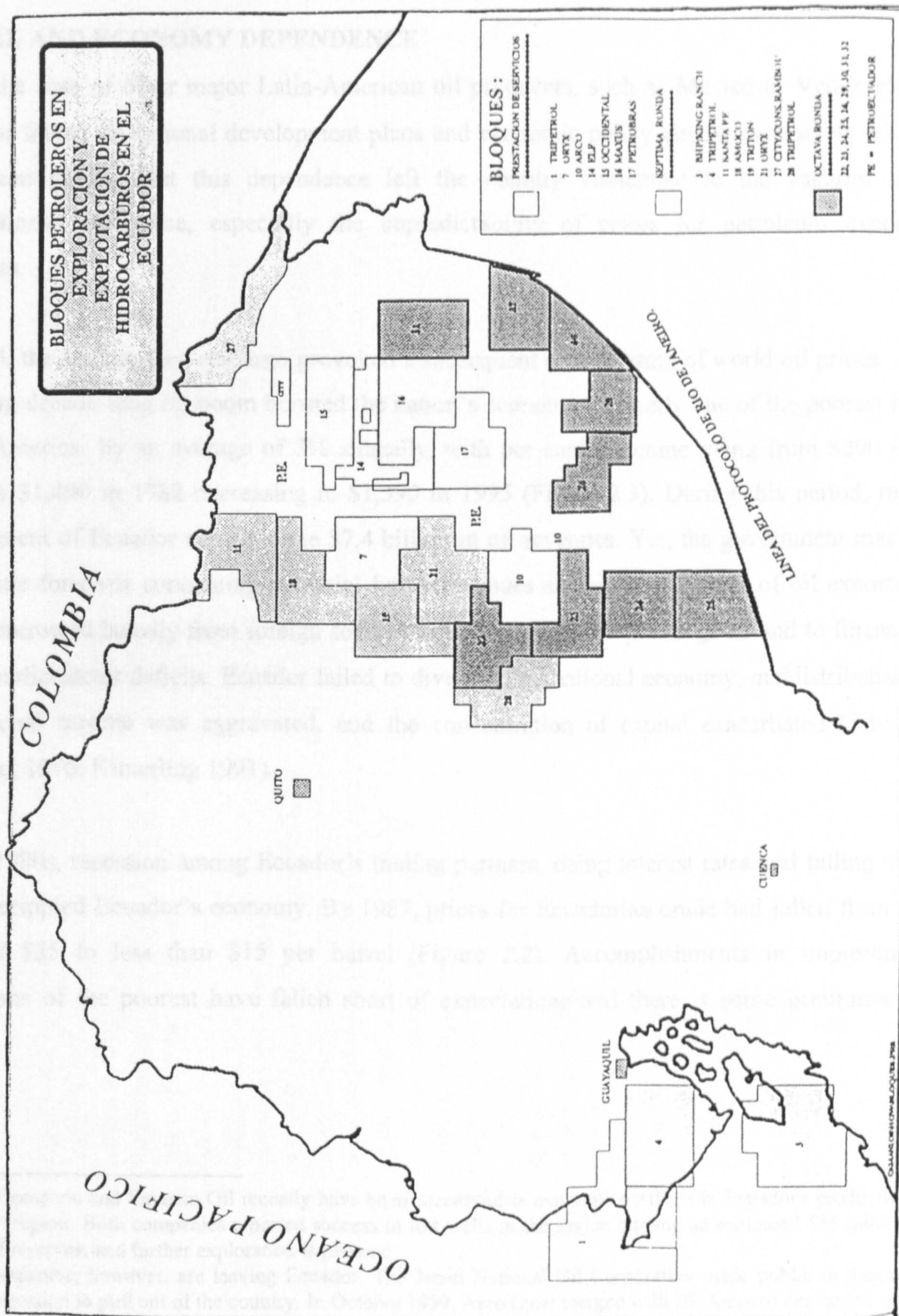
\* NP: National Park  
PA: Protected area  
WR: Wildlife Reserve

Ecuador has approved a plan to build a new pipeline to alleviate oil transport capacity constraints. The expansion has been planned in order to contribute significantly to economic growth<sup>23</sup>. Once the pipeline is completed, Ecuador's transport capacity could increase to as much as 700,000-800,000 bbc/d, allowing for significant increases in oil production (Environment Information Agency, 2001; World Bank, 2001).

<sup>23</sup> An international five-company consortium headed by Canada's Alberta Energy is moving forward to build this new major export pipeline. The new legislation allows private companies to own and operate pipelines in perpetuity; previously, facilities had to be returned to the government after a set period. The legislation also authorises pipeline owners to set tariffs and relax requirements for downstream investment by producers.



Figure 2.1. Oil exploration and exploitation areas in Ecuador, 2000 (source: El Comercio, 2000).





Under current Petroecuador forecasts, output is then expected to decline naturally, to 200,000 bbl/d, by 2007. Petroecuador predicts that the country could become a net oil importer by 2010 (Environment Information Agency, 1997) (Figure 2.2)<sup>24</sup>.

## 2.2. OIL AND ECONOMY DEPENDENCE

As is the case of other major Latin-American oil producers, such as Mexico or Venezuela, Ecuador linked its national development plans and economic policy almost exclusively with petroleum policy. But this dependence left the country vulnerable to the vagaries of international commerce, especially the unpredictability of prices for petroleum export revenues.

In 1973, the Middle East embargo provoked a subsequent skyrocketing of world oil prices. A resulting decade-long oil boom boosted the nation's economy -formerly one of the poorest in Latin America- by an average of 7% annually, with per capita income rising from \$290 in 1972 to \$1,490 in 1982 decreasing to \$1,390 in 1995 (Figure 2.3). During this period, the government of Ecuador earned some \$7,4 billion in oil revenues. Yet, the government made optimistic forecasts concerning potential future revenues accruing as a result of oil exports, and it borrowed heavily from foreign sources to help meet development goals and to finance large public-sector deficits. Ecuador failed to diversify the national economy, maldistribution of national income was aggravated, and the concentration of capital exacerbated (Silva-Luvecce, 1976; Kimerling 1991).

In the 1980s, recession among Ecuador's trading partners, rising interest rates and falling oil prices, crippled Ecuador's economy. By 1987, prices for Ecuadorian crude had fallen from a high of \$25 to less than \$15 per barrel (Figure 2.2). Accomplishments in improving conditions of the poorest have fallen short of expectations and there is some preliminary

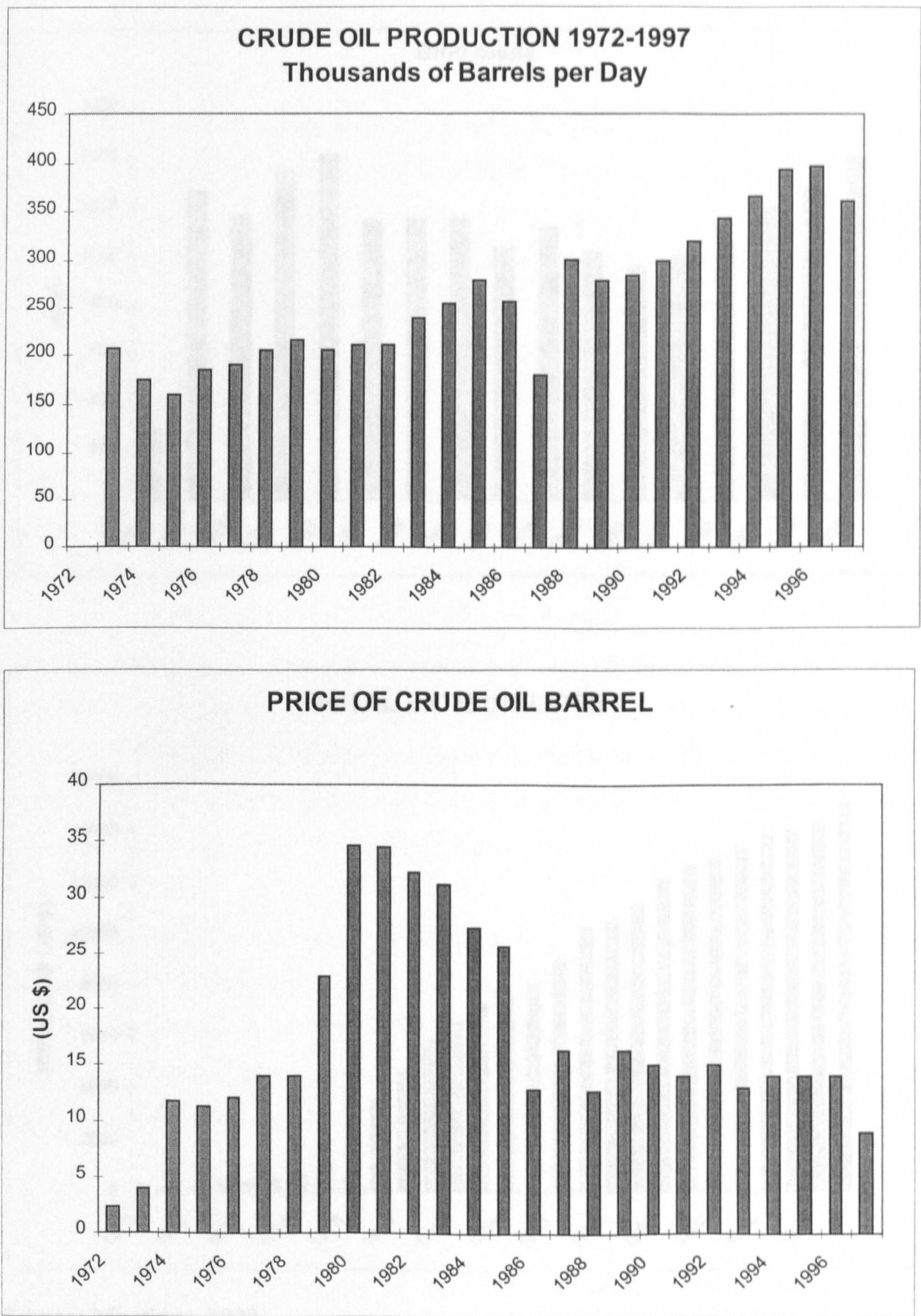
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<sup>24</sup> Perez Companc and Cayman Oil recently have been successful in exploration efforts in Ecuador's productive "Oriente" region. Both companies reported success in test wells in the region tapping an estimated 555 million barrels of reserves, and further exploration is planned.

Other companies, however, are leaving Ecuador. The Japan National Oil Corporation made public in August 1999 its decision to pull out of the country. In October 1999, Arco (now merged with BP Amoco) decided to sell its assets in Ecuador, as well as exploration properties in Colombia and Peru. Italy's Agip, a consortium member in Arco's Ecuador production, took over as operator in Arco's Villano field. In July 2000, CMS Energy sold its Ecuadorian assets to Crestar Energy of Alberta, Canada (Environment Information Agency, 2001).



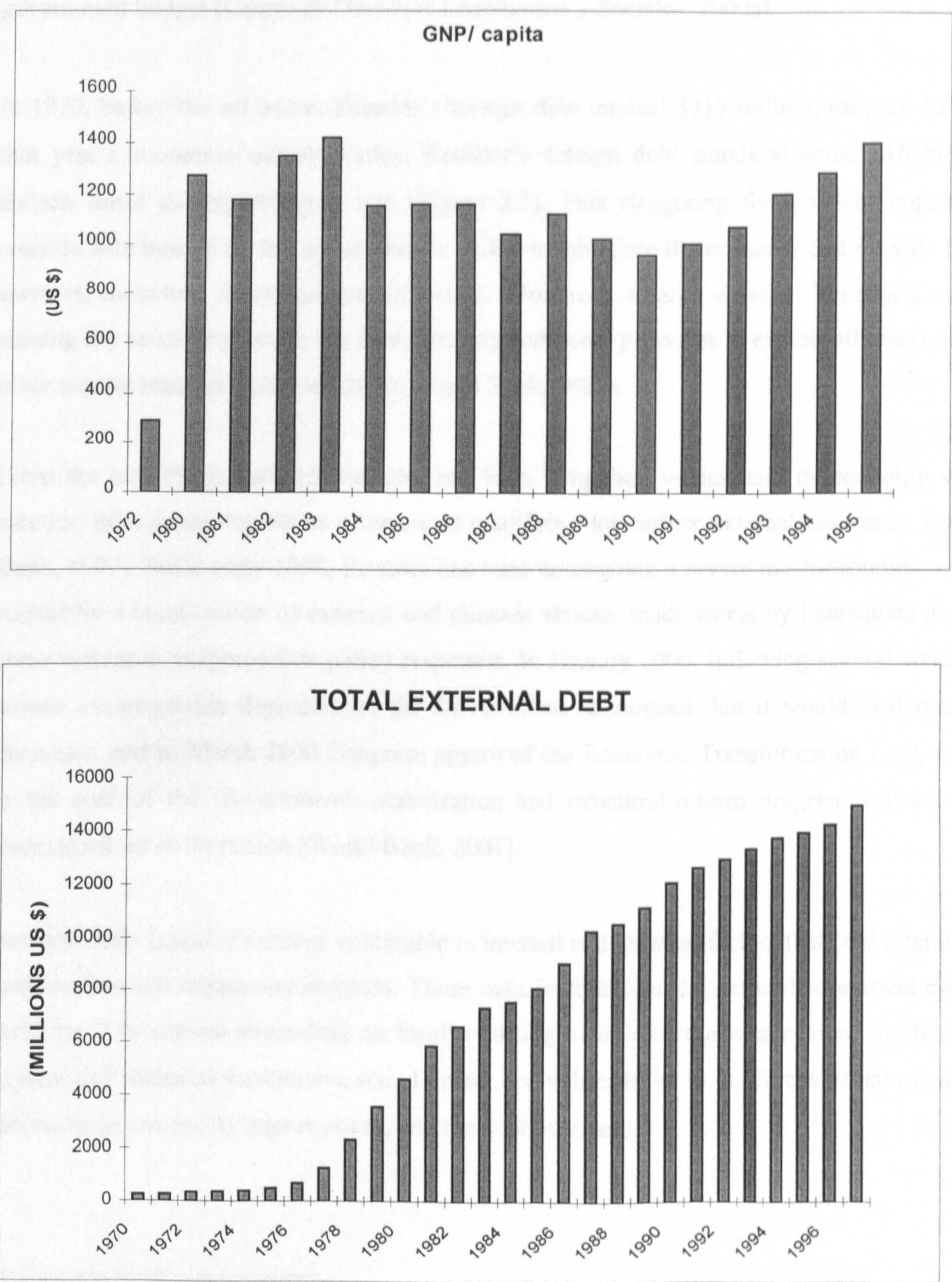
Figure 2.2. Crude oil production and oil prices; Ecuador 1972-1997.



Source: Petroecuador, 1995; Martínez, 2000.



Figure 2.3. GNP per capita and total external debt; Ecuador 1972-1997.



Source: Martínez, 2000.



evidence that income distribution during the 1990s has worsened (World Bank, 1997)<sup>25</sup>. Today, oil continues to account for nearly 40% of the nation's export earnings and government budget (Centro de Derechos Económicos y Sociales, 2000a).

In 1970, before the oil boom, Ecuador's foreign debt totalled \$217 million, roughly 12% of that year's economic output. Today, Ecuador's foreign debt stands at some \$16 billion, sixteen times its export/import rate (Figure 2.3). This staggering foreign debt imposes a considerable burden on the government's ability to stimulate the economy and provide basic services, including environmental protection. Moreover, a large share of Ecuador's export earnings are needed to service the debt, creating additional pressures to exploit oil reserves and other natural resources (Acosta, 2000; World Bank, 2001).

From the mid-1980s forward, Ecuador has been struggling to maintain its economy while meeting debt commitments as a means of qualifying for further external assistance (World Bank, 1997). Since early 1998, Ecuador has been undergoing a severe macroeconomic crisis, caused by a combination of external and climatic shocks, made worse by inadequate and, in some instances, inappropriate policy responses. In January 2000, following several weeks of severe exchange-rate depreciation, the Government announced that it would dollarize the economy, and in March 2000 Congress approved the Economic Transformation Law, which is the core of the Government's stabilisation and structural-reform program and sets the framework for dollarization (World Bank, 2001).

Nevertheless, Ecuador remains vulnerable to internal and external factors that could derail the stabilisation and adjustment program. These risks include Ecuador's complex political system with the Government depending on fragile shifting coalitions, the weakness of the banking system and financial institutions, social unrest, the vulnerability to the forces of nature and to fluctuating commodity export prices, and the debt overhang.

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<sup>25</sup> Poverty incidence, which had already increased from 34 to 46 percent from 1995 to 1998, stood at continued to increase in 1999. About 88 percent of the rural population are now living in poverty, compared with 69 percent in 1999 and 54 percent in 1995. The number of people living in extreme poverty (insufficient income for a minimum food basket) had climbed from 15 to 17 percent from 1995 to 1998 and jumped to 34 percent of the population in 1999. The unemployment rate for the lowest income quintile doubled between May 1998 and August 1999 (16.9 percent) and is now also twice the average for the population as a whole (World Bank, 2001).



## 2.3. OIL DEVELOPMENT POLICIES

### 2.3.1. Government

The beginning of the extraction of Amazon petroleum in 1972 opened a new era for Ecuador. Both military and civilian leaders found basic economic and social policy increasingly dependent upon petroleum earnings. It fell to the military, as the first to rule in the time of the boom (1972-79), to extend dramatically the authority of the state over the oil development process. Reliance on greater income from petroleum as a means of generating a modernising economy was profound, although the transformations anticipated by many optimists were not fully realised (Bromley, 1977). At the end of the 70s, economical conditions had been drastically altered and Ecuador was struggling for economy stability. The combination of domestic uncertainties, economic problems, the failing international market, plus the external demands of debt repayment, all pushed the government towards caution and conservatism in the framing and implementing of policy (Martz, 1987).

Until 1972, petroleum contracts and legislation were characterised by the practice of *arrendamiento* (concessionary renting or leasing to the company). But from this date, the new Law of Hydrocarbons brought what would be the leading oil policy for the next years. Ecuador oil guideline was set forth in the first five articles:

- i) oil reserves were the inalienable patrimony of the state, which would explore or exploit via CEPE while retaining the right to transportation and refining;
- ii) all petroleum policy was to be set by the state, which also held the uncompromising authority to establish norms for the utilisation and conservation of reserves;
- iii) the system of concessions was ended and CEPE might sign only two types of contracts with oil companies: contracts of association, and contracts for the borrowing of services;
- iv) oil companies would be required to pay surface and entry rights, royalties, tax contributions for education, transportation fees for pipeline usage, and compensatory public works in the region contracted;
- v) only national government could set reference prices and determine the cost of crude oil and derivatives for domestic consumption (Martínez, 1995).

Despite all the regulation of economic aspects of oil development, including producing rates, and its active participation in development activities, the state has failed to establish



meaningful environmental controls. Oil companies have been virtually self-regulating, and environmental standards were set by corporate policy rather than law<sup>26</sup> (Kimerling, 1995). As a result, it is not surprising that despite the fact that Ecuadorian constitutional and statutory law clearly recognises the public interest in a clean and healthy environment, and charge the state with environmental protection responsibilities, successive governments have shown little or no willingness to comply. Implementing regulations are underdeveloped, and oversight and enforcement mechanisms are inadequate. For instance, even when legal requirements are precise, such as the prohibition on dumping untreated oil on roads, routing violations are overlooked, and the law is not enforced (Fundación Natura, 1996; Kimerling, 1998).

The conservative government elected in 1992 declared that intensified oil production would be a primary goal of its administration. It envisaged an aggressive strategy that included: withdrawal from OPEC to avoid its limitations on oil export quotas and thus increase its petroleum exports; a drastic reform of the Hydrocarbons Law to favour foreign investment; widespread privatisation of the state-owned oil companies; a new bidding round in 2001 for concessions and service contracts to explore 13 new oil blocks; the construction of a new oil pipeline, and negotiations with the World Bank and International Monetary Fund to receive fresh financial support to address these reforms (Fabra, 1998; Centro de Derechos Económicos y Sociales, 2000a).

In 1999, Ecuador began searching for private sector participation to help raise recovery rates and boost production from a number of active fields. These include, initially, the two largest, Shushufindi and Sacha, estimated to have 976 million barrels (bbc), of proven reserves, and the Auca, Lago Agrio, and Libertador fields later. The government hopes to draw as much as \$2 billion worth of investments via new joint ventures, which include a clause guaranteeing

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<sup>26</sup> Companies appear to choose which standards to apply, and how to measure compliance. The promise to apply “International Standards”, “Best Practice” or some other variation of a new environmentally sound and socially responsible model of operation becomes “nice words” because affected communities, environmental and human rights advocates, and even government officials and policy makers do not really know what this means. Most written corporate commitments are general and inexplicit, and allow for considerable leeway in how to interpret them (Kimerling, 1998). For instance, Occidental oil company pledged to inject produced wastes below the water table, instead of discharging them into the environment. The extremely high water cut of its wells, however, has made reinjection more expensive than anticipated due to the large volume of wastes. As a result, the company’s injection rate was reported in 1997 at 23,000 barrels/day, accounting for less than one-third of the 68,000 barrels/day of produced water generated by the operations (Williams, 1997).



the state a minimum of 40 percent of the added production from the fields<sup>27</sup> (Environment Information Agency, 2001).

### 2.3.2. Petroecuador

In 1972, Petroecuador (former CEPE) was designed to minimise foreign influence, control the national resource, and produce profit for the benefit of the country. Although circumstances have changed over time, there has been an effort to maintain the basic premises on which Petroecuador was created and integrated into the industry. The policy content has been based on several points: i) judgement about external factors, especially world demand, ii) the structural conditions of the industry, and iii) political questions such as the attitudes of the president and the domestic business sector leadership (Zeballos, 1981). Petroecuador has operated in virtually all aspects of the industry, although the upstream search for new deposits have relied substantially on multinational participation.

In 1990, Petroecuador created the Environmental Protection Unit (EPU) with the aim of prevention and control of environmental pollution and avoid adverse effects of the socio-economic structure of the populations living in oil areas. However, in the field, some studies indicate that Petroecuador has shown little evidence of its new role in environmental protection (Kimerling, 1998; Talbot, 1999). Operations remain unchanged, and there is real concern whether Petroecuador has any intention of actually implementing new environmental requirements or whether top management is really committed to changing its operations (Ortiz and Varea, 1995). In addition, during the government period of 1992-96, within the process of state modernisation, the EPU reduced its personnel to the half, compromising its own functionality (Varea, 1995). The government has strong financial incentives to keep environmental expenditures down because when companies develop commercial fields, the state reimburses all production and exploration costs. In addition, many officials fear that if environmental protection becomes too costly, investment will go elsewhere (Kimerling, 1995).

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<sup>27</sup> Despite these plans are under attack from critics who believe that the smaller fields should be opened for competition first and that transportation bottlenecks will interfere with exports, the government is determined to proceed as planned. In addition, the government's decision to charge the winners a \$40 million bonus per field, has drawn criticism from experts who believe the amount of the bonus should be based on the quality of each field. This, and a number of other issues such as control over crude oil and installed equipment utilisation, as well as coexistence with Petroecuador, are just a few of the many complicated factors that could affect the eventual success of the plan (Environment Information Agency, 2001).



The last government (2000) has planned to grant Petroecuador, more fiscal and administrative independence, and has encouraged the company to seek greater private sector participation through joint ventures. In order to improve Petroecuador's current financial standing (\$70 million debt) the company is going to depend less on the national treasury, for which it has historically relied on for its operating budget. In addition, Petroecuador's workforce is being cut and efforts are being made, supported by the new constitution, to reduce the power of the labour unions (Environment Information Agency, 2001).

Some authors argue that the highly politicised structure of Petroecuador - 10 executive presidents in 10 years - and the cut-off by the Ministry of Finance of the exploitation budget have made the management of the company almost impossible and its role in the near future completely uncertain (Andrade, 1998; Arauz, 1999) <sup>28</sup>.

### **2.3.3. Multinationals**

The development of oil in Ecuador has followed a common pattern to most developing countries (Rainforest Action Network, 1998). Throughout the years, the competition for leverage and power between host government and multinationals was established and the familiar bargaining pattern emerged. By the close of the military period (1979), the balance of power had clearly shifted from the host country to the multinationals (Martz, 1987).

Oil transnational companies (TNCs) activities have characterised by the logic of quick accumulation and little investment, without taking into account the energy or raw material requirements of the host country. Until recently, there has been little emphasis on corporate responsibility in understanding or protecting the biological, socio-economic and cultural conditions where companies operate. A lack of adequate government control over petroleum development to protect the environment supported companies objectives (Ortiz and Varea, 1995).

For instance, during its twenty years of operations in Ecuador, which ended in 1992, Texaco discharged an estimated 4.3 million gallons of toxic "produced water" per day into the

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<sup>28</sup> The current government is expecting the privatisation of Petroecuador in the coming year or two though a specific privatisation plan has not yet been offered. Joint ventures between Petroecuador and private oil companies already are becoming increasingly common, and private foreign production accounted for increasing proportions of overall production throughout the 1990s (Environment Information Agency, 2001).



environment of the “Oriente”, despite oil industry standards that suggest reinjecting the wastes back into the ground (Kimerling, 2000). Texaco has justified its actions by noting that its operations were conducted in compliance with Ecuadorian law<sup>29</sup>. Yet, Texaco’s contract specifically required it to “adopt suitable measures to protect the flora, fauna, and other natural resources, and to prevent contamination of water, air, and soil”, an obligation reaffirmed in Ecuador’s civil code (Press, 1999).

Without dismissing state responsibility to ensure that environmental regulation is in place to control TNC activities, the relationship-gap between them is huge. The sheer size and economic power of these TNCs is enormous. For instance, in 1995 a study reported that the annual budget of Texaco was 40 times the budget of Ecuador (Garzón, 1995). Oil companies have levered power through threats to leave the country as a means to dissuade government from enacting or enforcing regulations (Kimerling, 1991).

However, in the last years, some changes in the attitudes of the oil companies have been observed. Efforts to improve environmental practices and community relations apparently began around 1990, after revelations about irresponsible oil field practices by Texaco and other companies in Ecuador’s Amazon region spawned a surge in national and international concern about the impact of oil development on human rights and the environment in the tropics, and buttressed longstanding local grievances and demands for change. A number of companies publicly recognised that governments are not protecting the environment and pledged to go beyond what is required of them, for ethical reasons.

For instance, Occidental oil company have been promoting its Ecuador operations within selected circles in industry, government and NGOs, as a successful new model of responsible “world class” environmental protection and community relations. For example, in 1996, *The “Houston Chronicle”* reported that Occidental’s production in Block 15 “seems a model of how oil can be extracted in environmentally sensitive areas of the tropics” (Althaus, 1996). The following year, “*Oil and Gas Journal*” reported that Occidental “has implemented a comprehensive strategy of strict environmental protection measures and aggressive community relations initiatives” in Ecuador and characterised the undertaking an “unqualified success” and a “world class” environmental operation (Williams, 1997). On a local level,

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<sup>29</sup> See Texaco home page: <http://www.texaco.com/shared/position/docs/responsec.html>.



Occidental has repeatedly assured residents that its operations use the latest leading edge technology. The company has also produced a Spanish-language brochure entitled *Oxy, Certificada ISO 14001* (Oxy, ISO 14001 Certified) and a short English-language video called "The Human Face of Petroleum". These documents and materials suggest corporate responsibility and avow a commitment to protect the environment, respect indigenous cultures, be a good neighbour, and promote self-reliant sustainable development.

However, a recently report (Kimerling, 2001) has revealed that company's community relations are characterised by serious problems from the perspective of local residents<sup>30</sup> and an effort to obtain meaningful information about the company's environmental standards and practices indicates that Occidental is not willing or able to publicly disclose the information needed to verify its claims of environmental excellence (Kimerling, 1991; Jochnick et al., 1994).

Ecuador's economy has performed poorly since the early 1980s. The country accumulated debt for most of the previous decade, when the start of oil exports produced a brief period of high growth, and the 1980s debt crisis caused a growth crisis from which it has never fully recovered. Natural calamities, such as El Niño, and volatile conditions in world primary commodities markets, like the sharp decline in oil prices in 1998, have also affected growth. Since early 1998, Ecuador has been undergoing a severe macroeconomic crisis, caused by a combination of external and climatic shocks and, in some instances, inappropriate policy responses.

The Government announced in early March 2000 an economic and social program for the next 18 months, "Ecuador Opening 2000"<sup>31</sup>, whose objectives include restoring confidence in economic management, stemming the decline of economic activity, laying the foundations for

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<sup>30</sup> According to high level corporate officials in the USA, Occidental's land access policy in indigenous territories is clear: the company recognises and respects the right of indigenous peoples and communities to say "no" to oil development, and does not work in their lands without their "permission" and "consent" (however, see Uwa case in Colombia: <http://www.amazonwatch.org>). In addition, the company actively "supports indigenous land rights" in the areas where it operates, including efforts to secure legal land titles from national governments (Kimerling, 2001). However, the company has not committed to that standard in its legally binding documents with Ecuador and has expropriated all the indigenous lands that are used for production facilities.

<sup>31</sup> This program was set out in the Letter of Intent for an IMF stand-by program and the Letter of Development Policy for the World Bank Structural Adjustment Loan.



renewed economic growth and preventing the further deterioration of living standards and protecting the poor (World Bank, 2001).

For the oil development of the country, the project has four main components: the construction of an oil pipeline for heavy crude, the privatisation of the main oil production fields in the north-eastern part of the country, the privatisation of the refineries and the opening of two million hectares of tropical forest to oil development in the south of the country (Centro de Derechos Económicos y Sociales, 2000a).

The benefits of this program, if any<sup>32</sup>, will come in the following years.

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<sup>32</sup> According to the CDES (2000a), the aim of this program is to get immediately resources to apply the dolarization of the currency and to save the financial crisis of the national banks, releasing from responsibilities to the main guilties of the catastrophic economy of the country, the bankers and the powerful economic groups.



## APPENDIX 3

### EVENTS RELATED TO THE TEXACO CASE<sup>33</sup>.

YEAR	EVENTS
1972-1990	<ul style="list-style-type: none"> <li>• Texaco oil company and Petroecuador, Ecuador's state oil company, jointly explore for and produce oil in the "Oriente" through business partnership.</li> <li>• Residents of the "Oriente" complain about the oil contamination of the environment from oil wells and fields.</li> </ul>
1990	<ul style="list-style-type: none"> <li>• Texaco oil company leaves Ecuador after finishing the concession agreement.</li> </ul>
1992	<ul style="list-style-type: none"> <li>• Ecuadorian government decides to assess the environmental impact of Texaco's operations in the area. The government assigns the work to the Canadian HBT-Agra company.</li> </ul>
1993	<ul style="list-style-type: none"> <li>• A lawsuit is filed against Texaco from approximately 30,000 indigenous and peasants, who claimed that the oil company has caused irreparable damage to the rain forest by dumping millions of gallons of toxic-waste water into the Amazon rivers.</li> </ul>
1994	<ul style="list-style-type: none"> <li>• In July, the municipality of Lago Agrio, a small town in the Amazon oil-producing region of north-eastern Ecuador, files a \$2 billion lawsuit against Texaco for alleged environmental damages in the area. Texaco settle this suit for about \$1 million (Energy Information Administration, 1997).</li> <li>• The environmental impact assessment is finished. The audit concludes that Texaco acted responsibly and there was no lasting environmental impact from the former consortium operations (Texaco, 2001b).</li> <li>• However, the Ministry of Energy acknowledges that the environmental audit was inadequate, failed to address the company's effects on the local populations and did not fulfil the signed agreement (Rainforest Action Network News, 1998).</li> <li>• <i>FDA</i> is created with the participation of several peasant and indigenous organisations with the aim of supervising the lawsuit against Texaco.</li> </ul>
1995	<ul style="list-style-type: none"> <li>• In May, Texaco signs an agreement with Ecuador's government to undertake cleanup activities in return for releasing the company from future responsibility related to its former oil operations.</li> <li>• Local indigenous, peasants, and environmental groups reject the agreement, charging it addresses only a small part of Texaco's extensive impacts in the region.</li> </ul>
1996	<ul style="list-style-type: none"> <li>• The lawsuit against Texaco is dismissed in November on <i>forum non conveniens</i> and other grounds. The New York federal court is appealed by the plaintiffs' lawyers.</li> </ul>
1998	<ul style="list-style-type: none"> <li>• The \$40 million remediation program is completed in late summer. According to Texaco (2001b), producing wells and pits formerly utilised by the company were closed, produced water systems modified, cleared lands were replanted, and contaminated soil remediated.</li> <li>• Texaco's clean-up work is criticised by numerous local and international environmental and human rights organisations, including Ecuador's Ministry of</li> </ul>

<sup>33</sup> For more information: <http://www.texaco.org> and <http://www.texacorainforest.org>.



	<p>Energy and Mines (Rainforest Action Network News, 1998). According to them, only a handful of the toxic waste pits were closed by piling dirt over them; the majority of the 300 waste pits are still being used.</p> <ul style="list-style-type: none"> <li>• In October, the US Court of Appeals reverse Judge ruling, instructing the district court that the lawsuit could not be dismissed. In the following months, the Judge should decide if the case is held in New York or sent back to Ecuador.</li> </ul>
1999	<ul style="list-style-type: none"> <li>• A US national campaign, financed by the lawyers on the case, is launched to expose “Texaco’s practices and force the company to pay the clean up the environmental devastation in the region” (lawyer, personal communication). The campaign also accuses Texaco of racial and ethnic discrimination. According to the campaign, “it’s time that Texaco learns that devaluing the lives and well-being of people because of the colour of their skin is no longer acceptable for any American company” (<a href="http://www.texacorainforest.org">http://www.texacorainforest.org</a>).</li> <li>• Texaco responds with a press release: “Texaco is unwavering in its commitment to equality, tolerance and protection of the environment and the communities in which we operate. To allege that race was a factor in our operations is wrong and it is disgraceful. In the six-year history of this litigation, the plaintiffs have never asserted claims of racial discrimination. We find this desperate effort to gain media attention deeply offensive” (<a href="http://www.texaco.com">http://www.texaco.com</a>).</li> <li>• Rumours that Texaco and the plaintiffs’ lawyers have started to negotiate.</li> </ul>
2000	<ul style="list-style-type: none"> <li>• In January, Judge of the US District Court asks the parties in the litigation for additional information on the matter of whether the court of Ecuador is the appropriate venues for the litigation.</li> </ul>
2001	<ul style="list-style-type: none"> <li>• <i>FDA</i> organises workshops with the communities to assess if they would agree to negotiate with Texaco.</li> </ul>



## **APPENDIX 4**

### **LIST OF INFORMATION SOURCES**

#### **1. Local level:**

Ureña H, ex-president of San Carlos village

Sarango A, president of San Carlos village

Moreno R, health worker of San Carlos village

Shingre M, president of Taracoa village

Representatives from women groups from the following communities:

- Dayuma
- Taracoa
- Shushufindi
- Reina del Cisne

Leaders from the following communities:

- 28 de marzo
- La Primavera
- La Victoria
- Dayuma village
- Taracoa
- Flor de Manduro
- 18 de Noviembre

Yanza L, president of the Frente de Defensa de la Amazonía (FDA)

Riofrio B, vice-president of the Frente de Defensa de la Amazonía (FDA)

Silva M, president of the Comité de Afectados por Texaco

Dr Sisa J, lawyer of the Frente de Defensa de la Amazonía (FDA)

Soto A, president of the Comité de Afectados por las Actividades Extractivas

Zambrano D, vice-president of the Comité de Afectados por las Actividades Extractivas

Sádaba JE, bishop of the Vicariato of Aguarico

Goldaraz JM, priest of the capuchin order, Vicariato of Aguarico

Grandez R, priest of the capuchin order, Vicariato of Aguarico

Andueza JC, priest of the capuchin order, Vicariato of Aguarico



Sisters of the Mercedarias order, via Auca, Vicariato of Aguarico  
Sisters of the Lauritas order, Pompeya, Vicariato of Aguarico  
Fajardo P, representative of the Human Rights Office, Shushufindi  
Arruti J, representative Environmental Department of the Fco. de Orellana municipality  
Mamallacta L, president Indigenous Federation of the Orellana Province  
Alvarado R, health secretary Indigenous Federation of the Orellana Province  
Dr Quizpe E, Fundación Salud Amazónica  
Intriago N, social promotor Fundación Salud Amazónica  
Dr Lahuasi B, Provincial Director of the Ministry of Health, Orellana  
Dr Rivadeneira R, private practitioner, Fco. de Orellana  
Dr Cordoba JA, coordinator Community Health Workers Health Programme, Orellana  
Villacreces L, director Water and Soil Laboratory of the P. Miguel Gamboa Technical School,  
Orellana

## **2. National/ international level:**

Dr Meneses C, National Director of Environmental Health, Ministry of Health  
Dr Quizpe A, dean Faculty of Medicine, University of Cuenca, Ecuador  
Garzón P, coordinator Centro de Derechos Económicos y Sociales (CDES)  
Dr Alvarado R, health coordinator National Confederation of Indigenous Nationalities of Ecuador  
Dr Vaca R, president Human Resources Commission, Judiciary National Board  
Apalategui I, president of Medicus Mundi Guipúzcoa  
Gonzalez JL, representative of Medicus Mundi in Ecuador  
Donzinger S, lawyer of the plaintiffs against Texaco oil company  
Kimerling J, environmental lawyer  
Dr Díaz-Barriga F, director Environmental Toxicology Laboratory, Universidad Autónoma San Luis de Potosí, Mexico  
Dr Arauz V, Environmental Office of the Pan American Health Organisation, Ecuador  
Borja L, public relation Kerr McGee oil company  
Gallegos W, public relation Oxy oil company



## **APPENDIX 5**

### **OTHER OIL RELATED HAZARDS**

There are several issues that occur as a component of oil development that they require separate attention. Of particular concern are the labour mobility, resettlement, deforestation and agro-industrial activities.

#### **5.1. LABOUR MOBILITY**

Oil development process, especially during the exploratory stage, is accompanied by labour mobility. Temporary workers, drawn from a largely underdeveloped hinterland, are exposed to severe health hazards. These hazards are generally occupational or associated with poor living conditions (McNabb et al., 1994). Migrant workers are also vulnerable to psychiatric disorders (International Labour Office, 1986). Most of these workers live without their families, presenting a high risk situation for communicable disease transmission, such as STD and HIV (Hunt, 1989).

Of major concern in the area is the potential risk for onchocerciasis, due to migration of carriers from endemic coastal areas to the Amazon region where the vector is abundant but no disease has been diagnosed yet.

Migrant labourers may choose to remain when a construction project is completed. They may create new settlements without infrastructure, live in unsanitary conditions and contribute to disputes over land and common property resources (Odingo, 1979) (see below).

#### **5.2. RESETTLEMENT**

Government has viewed the Amazon and their people as a frontier to be conquered, a source of wealth for the debt-burdened state and an escape valve for demographic and land distribution (Kimerling, 1995). As a result, indigenous people have been increasingly threatened by aggressive government policies that seek to develop and colonise their lands and to assimilate them into the dominant Ecuadorian culture.

Lured by government policies that promise easy credit and land ownership, *colonos* came from rural areas where growing populations, ecological deterioration, periodic droughts, and a



long history of abuse by the wealthy few who control most of the productive land, left them with little or no means to feed their families. Over the course of years of oil development in the northern “Oriente”, the influx of colonists more than tripled the local population from 74,000 to 260,000. The government's 1982 census revealed that the “Oriente” was growing at twice the rate of the rest of the country (Jochnick, 1995).

Among the colonist, government has promoted clearing the rain forest for crops or pastures as a means to demonstrate use and domain of land. The “Wastelands Law” granted legal title to any person that cleared rain forest and put it to productive use. The resulting deforestation (see below), has been exacerbated by the poor quality of Amazon soils and inappropriate farming techniques, which encourage the continual clearing of new land. Vector borne communicable diseases are often significant in resettlement schemes because of increased exposure or the creation of new vector-breeding sites (McGreevy et al., 1989).

Poor settlers who migrate to the “Oriente” in search of land and a better life are confronted with the realities of a rain forest ecosystem that does not permit sustainable cash-crop farming or cattle ranching. In a study carried out in the area, health workers found malnutrition rates of 65-70% among peasants schoolchildren (Kimerling, 1991).

### **5.3. DEFORESTATION**

Oil development in the “Oriente” has also resulted in massive deforestation. In addition to the areas cleared directly by oil companies, their access roads provide the main arteries for new colonisation of forest area and a big market for logging companies.

Ecuador has the highest rate of deforestation in South America, losing 45,000 hectares or 2.3% of its forests annually in great part as consequence of the expanding oil frontier. If the current rate of deforestation continues, Ecuador's Amazonian rain forest will be decimated within 15 years (World Resources Institute, 1990).

#### **5.3.1. Health hazards**

The immediate consequence of deforestation is a loss of biological biodiversity. Biological diversity is responsible of making soils fertile, creates the air we breathe, and provides food and other life-sustaining natural products, most of which remain to be discovered. The extinction of some species is strongly suspected because many of the plants and animals are



endemic to this area (Smith and Schultes, 1990). Loss of sacred places, loss of nutritional sources and medicines for native groups (and even for western medicine) and disturbance of the ecosystem equilibrium will have enormous implications for the health.

In addition, food supplies would be threatened. Deforestation, for example, will result in significantly reduced rainfall and loss of topsoil from erosion in adjacent agricultural areas and even in regions at some distance, compromising crop productivity (Mann, 1990).

In these conditions, infectious diseases such as malaria (McGreevy et al., 1989), leishmaniasis (Mouchet et al., 1994), Chagas (Coura et al., 1994) or even yellow fever, may increase substantially, or may become epidemic, as the equilibrium between hosts and parasites and between predators and prey are disturbed by habitat destruction or by a loss in biodiversity (Walsh et al., 1993).

#### **5.4. AGRO-INDUSTRY**

The network of roads opened in the forest by oil activities together with cheap labour supplied by colonists provided in the oil-palm industry a new means to practice the developmentalism model. At present some 30,000 hectares of African palms are being cultivated in the “Oriente” with plans to increase the area under cultivation. The environmental damage is already huge; again cleared rain forest, polluted rivers with toxic pesticides killing fish and contaminating drinking water. This has already had an extreme impact on indigenous communities, depending on forest and water for living, forcing them to migrate to remote areas (Confederación de Nacionalidades Indígenas de la Amazonía Ecuatoriana, 1985).

##### **5.4.1. Health hazards**

Notwithstanding the lack of data on health effect of pesticide use and water pollution in the area, there is an increased risk of both occupational and food-borne pollutants exposure to workers, their children, and entire communities.

Extrapolation of results from in vivo studies to human suggests the possibility of incrementally increased risk of cancer from many of the pesticides in use. Epidemiological correlation has been found between breast cancer in women and elevated serum levels of DDE, a major metabolite of DDT (Wolf et al., 1993). Given the lack of toxicity and epidemiological data on most of pesticides residues, there is great concern with respect to



low-level exposure to humans and potential outcomes of cancer (Zahm et al., 1997), immunotoxicity (Thomas, 1995) and reproductive effects (Rupa et al., 1991).

Finally a lack of control about pesticides can contribute to the resistance on one hand, of disease vectors to the chemicals used to control them and on the other of human disease vectors such as mosquitoes and triatomas responsible of transmission of malaria and Chagas respectively.

Once more, economic interests prevail over human, environment and even national development where production for export market is the main objective in a country that import 30% of its cooking oil (Myrick, 1987).



## **APPENDIX 6**

### **HEALTH IMPACT OF EXPOSURE TO PETROCHEMICAL INDUSTRY POLLUTANTS**

It is important to note that, although epidemiological evidence linking morbidity and mortality to exposure to pollution on petrochemical industry is not available in Ecuador, the range of possible ill-effects can be inferred from experience in other countries.

#### **6.1. HEALTH HAZARD**

##### **6.1.1. Occupational exposure**

Harrington (1987) reviewed 120 papers on the health effects on workers in the petroleum manufacturing and distribution industry concluding that the results were inconsistent, mostly due to the quality of the studies. In addition to the epidemiological limitations, there are growing suspicions about scientific objectivity when industries supporting research (Wing, 1998). In Table 6.1 a summary of literature on occupational exposure to petroleum and its association to malignancies is presented.

In 1989, IARC (1989) considered there was inadequate evidence for the carcinogenicity in humans of crude oil. However, recent epidemiological studies have reported direct evidence of the carcinogenic effects of PAHs (component of crude oil) in occupationally exposed subjects (Mastrangelo et al., 1996).

The relationship between psychosocial factors at work and impaired mental well-being has been demonstrated repeatedly in many countries (International Labour Office, 1986).

##### **6.1.2. Residential exposure**

Residential exposure to petroleum air emissions has been associated with an increased incidence of cancer of the buccal cavity, pharynx, stomach, lung, prostate, kidney lymphatic and haematopoietic (Kaldor et al., 1984; Sans et al., 1995). Kaldor et al. (1984) also found a strong association between degree of residential exposure and death rates from cardiovascular disease and cancer. An elevated risk of brain cancer has been suggested by a study of people



**Table 6.1. Summary of literature on occupational exposure to petroleum.**

Author	Year	Research cent.	Study	Occupation	Outcome
Theriault and Provenchor	1987	McGill Univ., Montreal	Retrospective	Refinery	Brain cancers
Bertazzi et al.	1989	Occup. Health Inst.	Retrospective	Refinery	Leukaemia, kidney (production). Lung, all cancer (moving)
Wongsrichanalai et al.	1989	Univ. Alabama	Retrospective	Refinery	Leukaemia
Marsch et al.	1991	Univ. Pittsburgh (Shell)	Retrospective	Refinery Chemical	Linfoma, leukaemia, SNC and liver cancer
Rushton	1993	Thames Polytechnic	Retrospective	Refinery Distribution	R: leukaemia D: leukaemia, kidney
Poole et al.	1993	Epidemiology Resources Inc.	Retrospective	Refinery	NO association
Khalil	1995	Univ. Yarmouk Jordan	Cross-sectional	Refinery	Chromosomal aberrations in blood lymphocytes
Finkelstein	1996	Ministry Labour Ontario	Case control	Petrochemical (maintenance)	Mesothelioma
Cooper et al.	1997	Univ. Texas	Retrospective	Refinery Chemical manufacturing	Brain tumor, leukaemia
Divine et al.	1985	Texaco	Retrospective	Refinery Petrochemical	NO association
Divine and Barron	1987	Texaco	Retrospective	Producing Pipeline work.	NO association
Teta et al.	1991	Union Carbide Chemical	Retrospective	Petrochemical	Liver cancer
Shallenberger et al.	1992	Exxon	Retrospective	Refinery Chemical	NO association Kidney in blue collar workers
Dagg et al.	1992	Chevron	Retrospective	Refinery	Leukaemia, lymphoreticulosarcoma
Raabe and Wong	1996	Mobil Oil Corp	Retrospective	Refinery	NO association
Gamble et al.	1996	Exxon	Case control	Refinery	NO association
Collingwood et al.	1996	Mobil Oil Corp	Retrospective	Refinery	NO association
Tsai et al.	1993	Shell	Retrospective	Refinery Petrochemical	NO association
Satin et al.	1996	Chevron	Refinery	Retrospective	Bone, leukaemia, benign neoplasms *
Tsai et al.	1996	Shell	Retrospective	Refinery Petrochemical	NO association

\* Findings not related to employment.



living near a petrochemical plant (Olin et al., 1987), and residential proximity to the petroleum industry for more than 10 years has been reported to increase the risk of lung cancer (Gottlieb et al., 1982). Studies conducted in different Asian countries have reported an excess rate for liver cancer (Yang et al., 1997) and cancer mortality (Pan et al., 1994) to be associated with residence near petrochemical industries. A survey of cancer mortality from 1950 to 1969, in counties in the USA with significant petroleum industries, reported high rates of lung cancer among white females, suggesting a community effect (Blot et al., 1977). Finally, subjects exposed residentially for up to 17 years to chemicals dispersed from a waste oil reprocessing plant showed neurophysiological and neuropsychological impairment (Kilburn and Warshaw, 1995). Studies from USA have also reported negative results (Hearey et al., 1980).

Childhood leukaemia and other childhood cancers have been geographically associated with industrial atmospheric effluent, for example with petroleum derived volatiles in Great Britain (Knox and Gilman, 1997; 1998). By contrast, a study from Wales did not find an association between incidence of leukaemias and lymphomas in children and young people in the area around the BP Chemical site at Baglan Bay, South Wales (Lyons et al., 1995). A recent report around all industrial complexes that include major oil refineries in Great Britain found no evidence of association between residence near oil refineries and leukaemias or non-Hodgkin's lymphoma (Wilkinson et al., 1999).

Few studies have examined association between exposure to emissions from petrochemical industries and outcome of pregnancy. In one study conducted in Sweden, the miscarriage rate was slightly elevated in the exposed area though the study concluded that ambient community exposures were not associated with an increased risk of unfavourable pregnancy outcome (Axelsson and Molin, 1988). In Bulgaria an association between exposure to emissions from petrochemical industries and outcome of pregnancy showed a higher prevalence of spontaneous abortions among residents near the industries (Tabacova and Vucow, 1991). Another study in the same country indicated an increased incidence of complications of pregnancy (proteinuria, hyperemesis, arterial hypertension and nephropathy) among women residents of areas polluted by petrochemical industries compared to the average complication rate over the whole country (Tabacova and Balabaeva, 1993). An increased risk of spontaneous abortion for women workers with frequent exposure to petrochemicals compared with those working in non-chemical plants was found in China (Xu et al., 1998).







**B. ESTADO DE SALUD**

1. Ha tenido usted o alguien de la familia alguno de estos síntomas en las últimas dos semanas?  
(SI=1; NO=0)

	SEÑORA	<= 5 a.	6-15 a.	> 15 a.	TOTAL
Fiebre					
Dolor de cabeza					
Picor en los ojos/ojos rojos					
Ruido o dolor en el oído					
Picor en la nariz					
Dolor de garganta					
Dolor de muela					
Tos / Gripe					
Naúsea/ Vómito					
Diarrea					
Bronquitis					
Dolor, quemazón de estómago					
Dolor de barriga					
Dolor articulaciones (huesos)					
Dolor de cuerpo					
Ronchas rojas					
Granos en la piel					
Hongos en la piel					
Molestias al orinar					
Calambres					
Mareos					
Amortiguamiento en pies, manos					
Cansancio, debilidad					
Problemas para dormir					
Malaria					
Otros problemas					



2. Ha tenido usted o alguien de su familia alguna de estas enfermedades durante el año pasado? (SI=1; NO=0)                      SEÑORA    <= 5 a.                      6-15 a.                      > 15 a.                      TOTAL

Fiebre					
Dolor de cabeza					
Picor en los ojos/ojos rojos					
Ruido o dolor en el oido					
Picor en la nariz					
Dolor de garganta					
Dolor de muela					
Tos / Gripe					
Naúsea/ Vómito					
Diarrea					
Bronquitis					
Dolor, quemazón de estómago					
Dolor de barriga					
Dolor articulaciones (huesos)					
Dolor de cuerpo					
Ronchas rojas					
Granos en la piel					
Hongos en la piel					
Molestias al orinar					
Calambres					
Mareos					
Amortiguamiento en pies, manos					
Cansancio, debilidad					
Problemas para dormir					
Malaria					
Tuberculosis					
Cancer					
Problemas de la menstruacion					
Otros problemas					



**C. IMPEDIMENTO FISICO Y USO DE FACILIDADES MEDICAS**

**(SI=1; NO=0)**

- Ha perdido usted o alguien de su familia días de trabajo o escuela por estar enfermo en las 2 últimas semanas?

Señora    ☐    <= 5a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha estado usted o alguien de su familia enfermo en la cama en las 2 últimas semanas?

Señora    ☐    <= 5 a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha sido atendida usted o alguien de su familia por un médico o promotor de salud en las 2 últimas semanas?

Señora    ☐    <= 5 a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha sido atendida usted o alguien de su familia por un curandero en las 2 últimas semanas?

Señora    ☐    <= 5 a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha tomado usted o alguien de su familia algun medicamento recetado por un doctor, promotor de salud, o en la botica en las últimas 2 semanas?

Señora    ☐    <= 5 a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha estado usted o alguien de su familia hospitalizada en los últimos 12 meses?

Señora    ☐    <= 5 a. ☐    6-15 a. ☐    > 15 a. ☐

- Ha habido alguna muerte en su casa en los ultimos 12 meses? (Poner el nº de muertos)

1. <= 5 a. ☐    2. 6-15 a. ☐    3. > 15 a. ☐

Fecha de la muerte (Mes)    1.      2.      3.

Causa de la muerte    1. <= 5 a.    \_\_\_\_\_  
                                  2. 6-15 a.    \_\_\_\_\_  
                                  3. > 15 a.    \_\_\_\_\_



**D. EXPOSICION AL PETROLEO**

De dónde sabe tomar el agua para beber?

1. Lluvia    ☐
2. Pozo      ☐
3. Fuente    ☐
4. Estero     ☐
5. Río        ☐
6. Otro lugar ☐

Sabe tomar a veces agua del estero? (SI=1; NO=0)    ☐

Dónde sabe tomar el baño?

1. Lluvia    ☐
2. Pozo      ☐
3. Fuente    ☐
4. Estero     ☐
5. Río        ☐
6. Otro lugar ☐

Sabe bañarse a veces en el estero? (SI=1; NO=0)    ☐

Dónde sabe lavar la ropa?

1. Lluvia    ☐
2. Pozo      ☐
3. Fuente    ☐
4. Estero     ☐
5. Río        ☐
6. Otro lugar ☐

Sabe lavar la ropa a veces en el estero? (SI=1; NO=0)    ☐

Qué lejos está el estero de su casa?

1. < 200 m                      3. > 500 m.
2. 200-500 m.

Cree usted que el estero está contaminado? (SI=1; NO=0)    ☐

Cuánto cree que está contaminado?

0. Nada                      2. Algo
1. Un poco                  3. Mucho

Cree usted que el usar agua del estero puede afectar su salud?

0. No                          2. Algo
1. Un poco                  3. Mucho



E. CUESTIONARIO SOBRE EL EMBARAZO

1. En qué mes y año nació usted? (NS=99) M |\_\_|\_\_| A |\_\_|\_\_| o edad |\_\_|\_\_|
2. Qué edad tenía en su primer embarazo? |\_\_|\_\_|
3. Está embarazada en este momento? (SI=1; NO=0) |\_\_|
4. De cuántos meses? |\_\_|\_\_|
5. Ha tenido alguna vez en su vida un embarazo en el cual tuvo una pérdida, aborto o terminó con una nacido muerto? (SI=1; NO=0) |\_\_|
6. Cuántos abortos o pérdidas ha tenido durante su vida? |\_\_|\_\_|

Ha estado alguna vez embarazada en estos 6 últimos años?

RESULTADO del EMBARAZO	PRIM. EMBARA. (el último)	SEGUN. EMBAR. (el anterior)	TERCER EMBAR. (el anterior)
(SI=1; NO=0)	1. Nacido vivo 2. Aborto (pérdida) 3. Pretermino 4. Ectopico 5. Otro _____ Sexo ____ M ____ F	1. Nacido vivo 2. Aborto (pérdida) 3. Pretermino 4. Ectopico 5. Otro _____ Sexo ____ M ____ F	1. Nacido vivo 2. Aborto (pérdida) 3. Pretermino 4. Ectopico 5. Otro _____ Sexo ____ M ____ F
Está el huahua todavía vivo?	SI ____ NO ____ Fecha _____ Causa _____	SI ____ NO ____ Fecha _____ Causa _____	SI ____ NO ____ Fecha _____ Causa _____
Fecha de nacimiento (año)			
Cuántas semanas duró el embarazo?	NO SE ____ (99) _____ semanas	_____ semanas	_____ semanas
Fue el embarazo confirmado por un doctor?	SI ____ NO ____	SI ____ NO ____	SI ____ NO ____
Dónde dió a luz?	1. En casa 2. Centr.de salud 3. Hospital	1. En casa 2. Centr.de salud 3. Hospital	1. En casa 2. Centr.de salud 3. Hospital
Quién le atendió el parto en casa?	1. Madre/Suegra 2. El marido 3. Otro familiar 4. PS / Partera	1. Madre/Suegra 2. El marido 3. Otro familiar 4. PS / Partera	1. Madre/Suegra 2. El marido 3. Otro familiar 4. PS / Partera
Tuvo el nino algún defecto al nacer?	SI (describelo) ____ _____ NO ____ NO SE ____ (99)	SI (describelo) ____ _____ NO ____ NO SE ____ (99)	SI (describelo) ____ _____ NO ____ NO SE ____ (99)
Fumó usted durante el embarazo?	SI ____ NO ____	SI ____ NO ____	SI ____ NO ____
Bebió usted alcohol durante el embarazo?	SI ____ NO ____	SI ____ NO ____	SI ____ NO ____
Bebió alguna bebida especial			



durante el embarazo?	SI ____ NO ____	SI ____ NO ____	SI ____ NO ____
Tomó usted alguna medicina durante el embarazo?	SI ____ NO ____	SI ____ NO ____	SI ____ NO ____
Qué medicina?			
Estaba usted usando algún método de planificación familiar cuando quedó embarazada?	0. NO 1. DIU 2. Píldora 3. Otro	0. NO 1. DIU 2. Píldora 3. Otro	0. NO 1. DIU 2. Píldora 3. Otro

Ha tenido alguna vez una interrupción del embarazo (terminación médica)?

SI \_\_\_\_ NO \_\_\_\_

Fecha del embarazo	Semanas de embarazo	Razones para la terminación
		<div></div> <div></div>
		<div></div> <div></div>

Ha tenido alguna vez problema para quedarse embarazada? (SI=1; NO=0)    ☐

Fecha en que tuvo ese problema (año)       

Consultó al doctor por ello? (SI=1; NO=0)        ☐

Fecha de la consulta (año)                               

Recibió tratamiento por ese problema? (SI=1; NO=0) ☐

Fecha de ese tratamiento (año)                               

Ha trabajado su marido alguna vez limpiando pozos de petróleo? (SI=1; NO=0)    ☐

Fecha de ese trabajo (año)       

Cuánto tiempo trabajo? (meses)

1. 1-3 m.            2. 4-6 m.            3. >7 m.



## APPENDIX 8

### SUMMARY OF THE "YANA CURI" REPORT



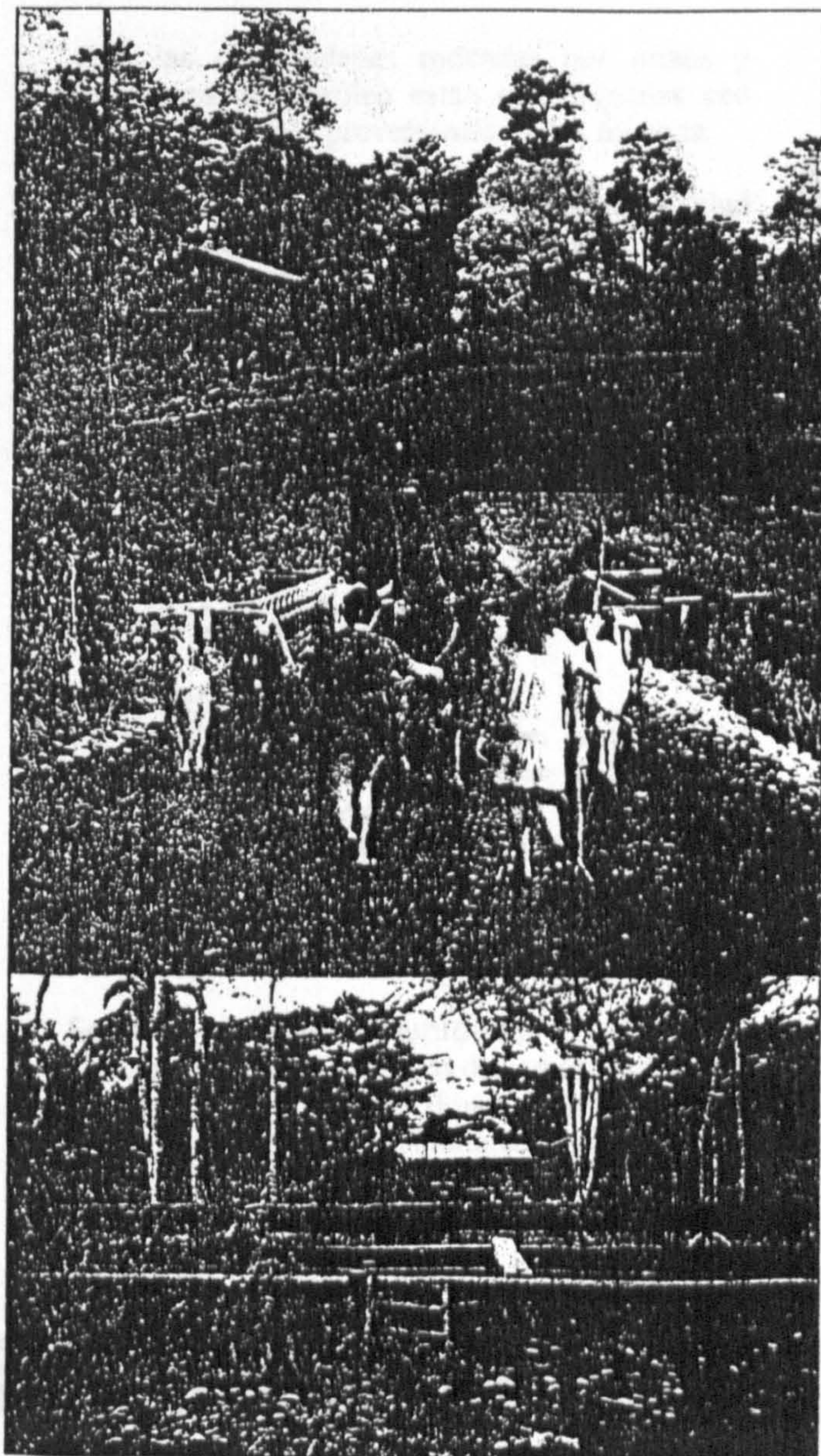
## FRENTE DE DEFENSA DE LA AMAZONIA

Nueva Loja - Sucumbíos  
Calle Eloy Alfaro 352 y Av. Colombia, Telefax: 06 831-930  
Coca - Orellana  
Pasaje s/n y Av. Amazonas, Telefax: 06 880-916

## 'INFORME YANA CURI

INSTITUTO DE EPIDEMIOLOGIA Y SALUD COMUNITARIA

"MANUEL AMUNARRIZ"



Desde 1972, compañías petroleras internacionales (Texaco, Oxy. Oryx, Elf, Maxus y otras) en colaboración con Petroecuador, han extraído más de dos billones de barriles de petróleo principalmente de la región amazónica. En este proceso, billones de galones de petróleo y desechos tóxicos han sido eliminados directamente al medio ambiente. Durante estos años, comunidades indígenas y campesinas así como grupos ecologistas nacionales se han organizado en clara oposición a una falta de regulación del desarrollo petrolero y han denunciado que la contaminación ha causado un enorme daño tanto al medio ambiente como a la salud de la población.

A pesar del evidente impacto sobre el medio ambiente que ha causado la explotación petrolera en la región amazónica y el potencial riesgo para la salud de sus habitantes, la información sobre el impacto en la salud de los residentes de las áreas petroleras es escasa. En este momento, se ha llegado al extremo donde las compañías petroleras y el propio gobierno han desafiado a las comunidades afectadas y grupos medio ambientales a proveer pruebas de los efectos adversos que para la salud tiene la explotación petrolera como condición a un cambio en sus estrategias de control de la contaminación.

Por ello, el Frente de Defensa de la Amazonía pidió en 1997 al equipo de salud del Vicariato de Aguarico la realización de un estudio epidemiológico que apoyara las demandas de comunidades y grupos medioambientales. El Vicariato de Aguarico, sensible a esta problemática y preocupación de las comunidades se ha lanzado en colaboración con la Escuela de Medicina Tropical e Higiene de Londres a investigar las posibles consecuencias que la contaminación por petróleo han podido causar en la salud de la población campesina de la Amazonía ecuatoriana.



# IMPACTO DE LA ACTIVIDAD PETROLERA EN LA SA

## OBJETIVO DE LA INVESTIGACION

1. Determinar si la población que vive en la proximidad de pozos petroleros en la Amazonia del Ecuador presenta un estado general de salud peor que los residentes de las áreas no petroleras. Si esto es así,
2. Averiguar si esta peor condición en el estado de salud se deben por la exposición de la población a los contaminantes provenientes de los pozos y estaciones de petróleo.

## PRINCIPALES HIPOTESIS

1. Que las comunidades rodeadas por pozos y estaciones de petróleo están contaminadas con productos tóxicos provenientes de los mismos.
2. Que los efectos de los contaminantes en la salud de los residentes en áreas petroleras son:
  - un peor estado general de salud
  - un exceso en el número de abortos espontáneos
3. Durante la investigación, se formuló también la hipótesis de que determinadas poblaciones en el área expuesta podrían estar experimentando un mayor riesgo de padecer cáncer.

## DISEÑO DEL ESTUDIO

1. **Area del estudio**  
El estudio ha sido realizado en comunidades campesinas situadas en los cantones de Orellana y Sachas en la provincia de Orellana y en el cantón Shushufindi en la provincia de Sucumbíos. Este área se eligió debido a la preocupación de la población y al largo período de actividad de las compañías petroleras en la zona.
2. **Selección de las comunidades**  
Se seleccionaron dos grupos de comunidades para el estudio: comunidades donde la población ha vivido expuesta a la contaminación proveniente de los pozos y estaciones de petróleo, y comunidades donde no hay contaminación por petróleo.

Se definieron como comunidades contaminadas aquellas comunidades localizadas dentro de un área de 5 km. alrededor de un pozo o estación de petróleo, siguiendo una dirección río abajo. Las comunidades no contaminadas se seleccionaron entre las que se encontraban a una distancia mínima de 30 km. en dirección río arriba.

Estos dos grupos de comunidades se compararon para ver si había diferencias en la salud de las poblaciones de ambos grupos.

### 3. Población del estudio

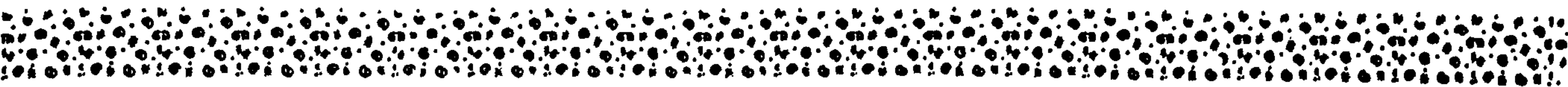
La población del estudio estuvo formada por mujeres con edad comprendida entre los 17 y los 45 años y con un tiempo mínimo de residencia en las comunidades de 3 años.

En total, se incluyeron en el estudio 9 comunidades del área contaminada (368 mujeres) y 14 de la no contaminada (291 mujeres).

## METODOS

1. Para determinar si las aguas de los ríos utilizados por las comunidades estaban contaminadas con petróleo se recogieron, durante los meses de febrero a abril de 1999, varias muestras de agua en cada comunidad del área contaminada y los análisis se realizaron en el colegio P. Miguel Gamboa de Coca.
2. Se preparó un cuestionario para administrar a la cabeza de familia de cada casa. El cuestionario consistió en tres partes: la primera recogió información de las características de la gente (edad, educación, ocupación de la mujer y de su marido, etc.); la segunda parte contenía información sobre la historia médica de las mujeres: en las últimas 2 semanas y durante los últimos 12 meses; la tercera parte del cuestionario recogió información sobre los tres últimos embarazos de las mujeres.
3. Se compararon los casos de cáncer encontrados en el recinto San Carlos con los que se deberían esperar si no hubiera habido contaminación. Los casos de San Carlos se compararon con los ocurridos en Quito.





# JD DE POBLACIONES DE LA AMAZONIA ECUATORIANA

## PRINCIPALES RESULTADOS

1. Evaluación medio ambiental

En la zona contaminada, 18 ríos pertenecientes a 8 comunidades estuvieron contaminados con petróleo, variando su concentración desde 0,02 partes por millón (ppm) en el río Manduro 1 hasta 2,883 ppm en el río Basura (Cuadro 1). El análisis del agua realizado mostró una severa exposición a los químicos del petróleo de los residentes de las comunidades expuestas. En algunos ríos, la concentración de petróleo superó en más de 100 veces el límite permitido por la ley de la Comunidad Europea. Estos datos confirman que los residentes de estas comunidades están expuestos a contaminantes provenientes de la actividad petrolera que exceden significativamente los límites de seguridad reconocidos internacionalmente.
2. Condiciones generales de salud

En las últimas dos semanas, las mujeres de las comunidades expuestas presentaron una mayor frecuencia de hongos en la piel, cansancio y otros síntomas que las mujeres residentes en comunidades donde no había petróleo.
3. Salud Reproductiva

En los últimos 12 meses, las mujeres de las comunidades expuestas presentaron también una mayor frecuencia de los siguientes síntomas: irritación de la nariz y de la garganta, dolor de cabeza, irritación de los ojos, dolor de oído, diarrea y gastritis.

Las mujeres de comunidades cercanas a pozos y estaciones petroleras presentaron un riesgo de abortos espontáneos 2,5 veces más alto, es decir un 150 % más, que las mujeres que vivían en comunidades no contaminadas.
4. Cáncer

La población de hombres del recinto San Carlos se encontró sometida a un riesgo de padecer cáncer muy superior al que se debería esperar dadas las características de su población. El riesgo fue particularmente elevado para los cánceres de laringe, hígado y de piel, el de estómago y el linfoma. Es de resaltar también el elevado riesgo al que estuvo sometida esta población de morir por cáncer, especialmente de los cánceres de estómago, hígado y de piel.

Cuadro 1. Concentración de Hidrocarburos Totales de Petróleo (HTP) <sup>a</sup> en los ríos de las comunidades rodeadas por pozos petroleros; Ecuador 1999.

	NOMBRE DEL RIO	HIDROCARBUROS TOTALES DE PETROLEO (ppm)	INCREMENTO SOBRE EL LIMITE PERMITIDO
Comunidad 1	Toachi	0	0
	Escuela 28-M	0	0
Comunidad 2	Pozo 66	0.04	4
	Río Negro	1.438	143
Comunidad 3	Victoria 1	0.051	5
	Victoria 2	1.426	142
Comunidad 4	Itaya 1	0.043	4
	Itaya 2	0.028	2
Comunidad 5	Escuela 18-N	0.036	3
	Jiménez	0.028	2
Comunidad 6	Huamayacu	1.444	144
	Basura	2.883	288
	Iniap	0.097	9
	Huamayacu verde	0.529	52
Comunidad 7	Lumu pueblo	0.066	6
	Lumu 3	0.055	5
Comunidad 8	Dayuma	0.145	14
Comunidad 9	Manduro 1	0.02	2
	Piscina Manduro	0.434	43
	Manduro 2	0.108	10

<sup>a</sup> El límite permitido para hidrocarburos totales en agua potable según la ley de la Comunidad Europea es de 0,01 partes por millón (ppm)





## CONCLUSIONES Y RECOMENDACIONES

1. Los residentes de comunidades cercanas a los pozos y estaciones de petróleo están expuestos a elevadas concentraciones de petróleo en las aguas de los ríos que utilizan habitualmente.
2. Los mujeres de comunidades cercanas a pozos y estaciones de petróleo presentan unas peores condiciones generales de salud y un riesgo de padecer abortos espontáneos mayor que los residentes de áreas no petroleras. Por último, en una de las comunidades del área expuesta, el riesgo de padecer y morir por cáncer en los hombres fue más elevado que el que cabría que esperar si no hubiera contaminación con los químicos del petróleo.
3. Los resultados de este estudio sugieren que los efectos adversos para la salud encontrados en las comunidades cercanas a los pozos y estaciones de petróleo son debidos a la contaminación proveniente de estos pozos y estaciones.

Debido a ello, sugerimos las siguientes recomendaciones:

1. Realizar un estudio más extenso en el área para detectar las posibles fuentes de contaminación, eliminarlas y establecer un sistema de monitoreo adecuado en el área. Mientras persista la contaminación por petróleo, la salud de ésta y otras poblaciones similares seguirá gravemente perjudicada.
2. Debido a la gravedad del cáncer, habría que pensar en establecer un sistema de vigilancia epidemiológica para esta enfermedad.
3. Para evitar que ocurran situaciones como la presente y asegurar que proyectos de desarrollo promuevan la salud, en vez de dañarla, dos cosas son necesarias:
  - el gobierno debe legislar y crear nuevas normas ambientales así como instituciones con poder de controlar la industria petrolera para eliminar cualquier amenaza a la salud pública y al medio ambiente, y les haga responsables de cualquier daño que puedan causar.
  - se necesitan estudios de impactos en la salud (no sólo de impacto medio ambiental) que integren medidas del riesgo ambiental y de la salud con una adecuada participación comunitaria.

Esperamos que el gobierno y las compañías petroleras en Ecuador puedan establecer un plan conjunto y adecuado, con participación comunitaria, que permita la eliminación de toda fuente de polución en la Amazonía y evitar de esta manera, este innecesario e inaceptable riesgo par la salud de sus habitantes.

**"E**s obligación del Estado respetar y asegurar los derechos de los habitantes del Oriente, y es responsabilidad del Estado implementar las medidas necesarias para remediar la situación actual y evitar toda contaminación futura a causa del petróleo que amenaza la vida y la salud de esa población." Comisión de Derechos Humanos de la Organización de Estados Americanos. Informe sobre Ecuador, 1997.

Por muchos años las poblaciones amazónicas han sufrido los impactos del desarrollo petrolero. El tamaño y poder de la industria y su supuesta importancia en el país ha dado una inevitable impresión de desarrollo petrolero con todas sus consecuencias; la complejidad de las actividades de la industria y su vinculación con la salud de las comunidades han ayudado a obscurecer los verdaderos daños. Así, los impactos sobre la salud evidenciados por los afectados han sido escondidos, cubiertos, negados y los han hecho parecer normales, "asi es la vida en la Amazonía."

Pero la mayor parte del sufrimiento humano no es natural ni inevitable —es resultado de decisiones y acciones deliberados y evitables. Este valioso informe ayuda a ver más claramente la situación sufrida por las comunidades en el Oriente y la vinculación con el desarrollo petrolero. El informe confirma con una profunda investigación científica lo que las comunidades sabían pero no podían probar. Como muestran estos datos, los problemas de salud, que en casos extremos han terminado en cáncer, son reales y están vinculados con la contaminación causada por las actividades petroleras. Las elevadas incidencias de cáncer no son naturales y tienen su fuente en decisiones económicas de botar los desechos tóxicos de las empresas y decisiones políticas del gobierno de ignorarlas.

Así, estas decisiones son claras violaciones de los derechos de las comunidades afectadas. El gobierno y las compañías han violado varios principios de la Constitución y de los tratados internacionales ratificados por Ecuador en los que se garantizan los derechos fundamentales de salud y de un medio ambiente sano. Se espera que informes de esta calidad dirigidos a solucionar problemas urgentes de la población provoquen más atención de los derechos violados y una mejoría en la calidad de vida de las comunidades afectadas.



Centro de Derechos Económicos y Sociales

Para más información sobre el estudio, contáctese con:  
Instituto de Epidemiología y Salud Comunitaria "Manuel Amunarriz"  
Avda. Alejandro Labaka s/n (frente al Sindicato de Choferes), Coca  
Telf.: (06) 880-550 E-mail: admin@mmcoca.ecuanex.net.ec



## APPENDIX 9

### **MEDIA WHERE THE CANCER CLUSTER AND THE “YANA CURI” REPORTS HAVE APPEARED.**

#### **1. Newspapers / Magazines**

<u>NEWSPAPER / MAGAZINE</u>	<u>TITLE</u>	<u>COUNTRY</u>	<u>DATE</u>
El Hoy	Cancer en la Amazonia	Ecuador	July 1999
InterPress Service	Natives in oil zones suffer high cancer rate	International	July 1999
Boston Herald	Rain forest pays the price of oil: suit claims Texaco polluted Ecuador	USA	August 1999
El Diario Vasco	Las petroleras deberan pagar los daños de la contaminación a la salud de los indígenas	Spain	Septemb. 1999
El Pais	El veneno del oro negro	Spain	July 2000
Mundo	Petroleo causa morte na selva equatoriana	Brasil	July 2000
El Comercio	Veinte casos de cancer	Ecuador	July 2000
Diario Medico	La actividad de las petroleras puede causar problemas de salud	Spain	Decemb. 2000
El Mundo	Un estudio revela que la actividad de Texaco perjudico a los nativos	Spain	Decemb. 2000
El Diario Vasco	La contaminacion del petroleo es el gran problema de salud en la Amazonia de Ecuador	Spain	Decemb. 2000
InterPress Service	European support sought in Texaco case	International	Decemb. 2000
Europa Press	Las petroleras de la Amazonia ecuatoriana perjudican la salud de los indígenas	International	Decemb. 2000
The Nation	Texaco on trial	USA	May, 1999
El Semanal	El paraíso enfermo	Spain	February 2001
Vida Nueva	El mal de Yana Curi	Spain/International	February 2001
El Ecologista	Oro negro en la selva	Spain	March 2001

#### **2. Radio**

Radio Sucumbios	Regional, Ecuador	May, June 1999 May, July 2000
Radio La Luna	National, Ecuador	June 2000
Radio Euskadi	Spain	December 2000
Radio Nacional	Spain	January 2001
Onda Cero	Spain	January 2001
Radio Exterior	Spain/International	January 2001

#### **3. Television**

La Television	Ecuador	October 2000
Television Española	Spain	December 2000
Canal Sur	Spain	December 2000
Primer Impacto	Ecuador	March 2001